THE AEROPLANE

Incorporating
Aeronautical Engineering
Edited by - - THURSTAN JAMES

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Founder and First Editor (1911-1939), C. G. GREY

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THE INDUSTRY'S UNRESOLVED FUTURE

IN the House of Commons last week Mr. de Freitas asked the Minister of Supply: "How many and which transport aircraft are on order for the Royal Air Force?" The answer, he was told by Mr. Aubrey Jones, is twenty Britannias. Mr. de Freitas then asked the Minister to ask the Secretary of State for Air why there is no replacement on order for the Valetta or Beverley? He added that this continual delay is giving great pleasure to the American aircraft industry and causing great concern to the British.

When Mr. Aubrey Jones replied that this question should be addressed to the Air Minister, he was asked by Sir Arthur Harvey whether he was aware that because of the delay in reaching decisions on these matters, American aircraft are being used to transport British troops and their families to the Commonwealth?

Mr. Emanuel Shinwell then spoke up and suggested that this and other Questions on the Paper to the right hon. Gentleman indicated considerable ambiguity in the House and elsewhere as to the Government's intentions for the future of the aircraft industry.

A little later on Sir Arthur Harvey asked the Minister of Supply what progress is being made in finalizing the specification of a supersonic airliner. Mr. Jones replied that the final report on the research study, now in progress, was not expected to be available for some time. Sir Arthur Harvey then made the point that this very important matter may seem a long way off today, but it will mean a great deal to Britain in years to come. Mr. Jones agreed the importance of the matter, but first we had, he said, to determine what the most economic shape of a supersonic civil aircraft is likely to be.

Mr. Mason next asked what representation Mr. Jones had made to the Service Ministers with a view to speeding up a co-ordinated decision on the Beverley and Canberra replacements. Failing to get the answer he sought, Mr. Mason became sarcastic and said that while appreciating that it was wasting time to question the Minister of Supply at all on these problems, was the Minister not aware that with the contraction of the aircraft industry many aircraft firms are put in an invidious predicament? Aircraft firms are interested in these replacements, are waiting for orders and are specially holding on to skilled labour. What did the Minister intend to do to alleviate the situation?

Sir Arthur Harvey then returned to the attack to ask the Minister if he were aware that the specification issued by his own Department to the aircraft industry went out over 18 months ago. What is the reason for this continued delay when the matter is desperate for so many people who are working in the factories? In reply to a question by Mr. Jay, Mr. Jones said that he recognized his responsibility for the aircraft industry, but could not place orders on the industry merely for the sake of maintaining the industry. He could only place orders on requirements determined by the Services.

We suppose that if the same or similar questions were addressed to the Service Ministers, there would be the same difficulty in getting firm answers; one ground for this would be the official answer that the Service requirements had yet to be formulated and there would probably be reference to the fact that decisions about overall policy, with all the implications for financial approval, were in the hands of the Minister of Defence. When one views such an imbroglio, the aircraft industry is fortunate that so many members in the House are prepared doggedly to press for information about future plans.

It was particularly encouraging to see Sir Arthur Harvey pressing for news of the supersonic airliner. As he said, it may seem a long time ahead but the Government's plans are of vital importance to the industry. Since he spoke a story has been published in the United States that the Russians are flying their supersonic bomber with atomic power. This has yet to be substantiated, but it should bring home to everybody that once again it is later than people have been thinking.

In this context we note that once again figures issued by the S.B.A.C. show record export figures, but here too it is later than most people think. The pipeline out of which these exports come must be getting very close to "sucking air," if it has not already done so. The exports now earning such substantial sums are the outcome of research and development work done over the past 10 years. That work has now been cut off. There have been no orders placed to follow the P.I. Lightning. It is hard to see many V bombers selling in the export market, though the Canberras have earned a great deal of welcome sterling.

The matter was re-opened on December 1. Questions were asked in the House about the Fairey Rotodyne, about orders for VTOL aircraft and later a request was made for a Select Committee to inquire into the present state of the aircraft industry. This request was refused by Mr. Aubrey Jones. The matter is to be raised again. We doubt whether committees and reports and discussions will do much good. As we have said, for many months now, a firm plan for British aeronautical development is the chief desideratum.

MATTERS OF MOMENT

Britain's Overseas Sales

ONCE again the Society of British Aircraft Constructors is able to announce encouraging figures for aviation exports from the United Kingdom. During the first 10 months of 1958 exports exceeded by 9% the previous annual record of 1957; the new figure of £126,883,826 represents an annual total of more than £150 million.

The January-October, 1958, total is almost double the 1955 annual figure; 21.5% more than in 1956 and 45% more than the total for the January-October period of last year.

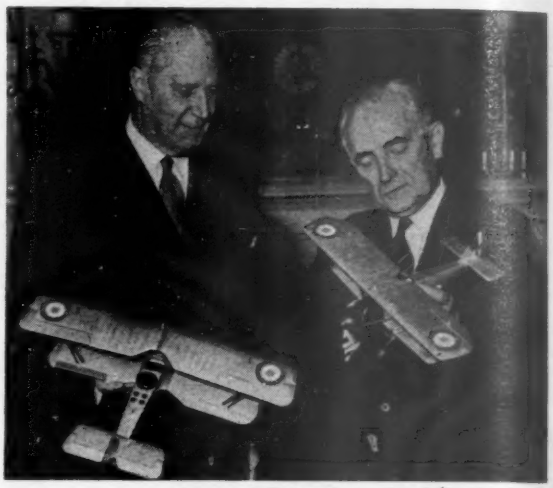
The aircraft industry's exports accounted for 4.8% of the total U.K. exports, and its share of exports to the U.S.A. represented 19.5%. Total aviation exports from Britain since the War now amount to more than £760 million.

In this year's 10-month period the sale of aircraft and parts amounted to £81,365,230 (compared with £69,767,417 during the whole of 1957); aero-engines, £40,532,824 (compared with £40,642,162); electrical parts and appliances, £2,845,975 (£3,267,975), tyres, £472,453 (£814,340), and aeronautical instruments, £1,667,344 (£1,979,216).

The leading overseas buyer of aircraft and parts was India (£15,514,467); then followed Canada (£13,471,828); the U.S.A. (£11,197,756); West Germany (£8,401,821); Australia (£2,904,692); the Netherlands (£2,250,671); Iraq (£1,807,898) and France (£1,669,207).

The October figure of £10,576,205 exceeded by £1.5 million the October, 1957, total, and was some £600,000 more than in the previous month. The individual totals were: aircraft and parts, £5,999,759; aero-engines, £3,941,253; electrical appliances, £355,666; tyres, £55,851, and aeronautical instruments, £223,676.

The leading buyers during the month were: the U.S.A., £1,510,697; West Germany, £727,809; India, £596,419; Switzerland, £496,894 and Turkey, £379,475.



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MODEL PRESENTATION.—The Hon. George Drew, Canadian High Commissioner (left) receives models of an A.W. Atlas and Siskin from Air Cdre. W. Wynter-Morgan.

A Gift to Canada

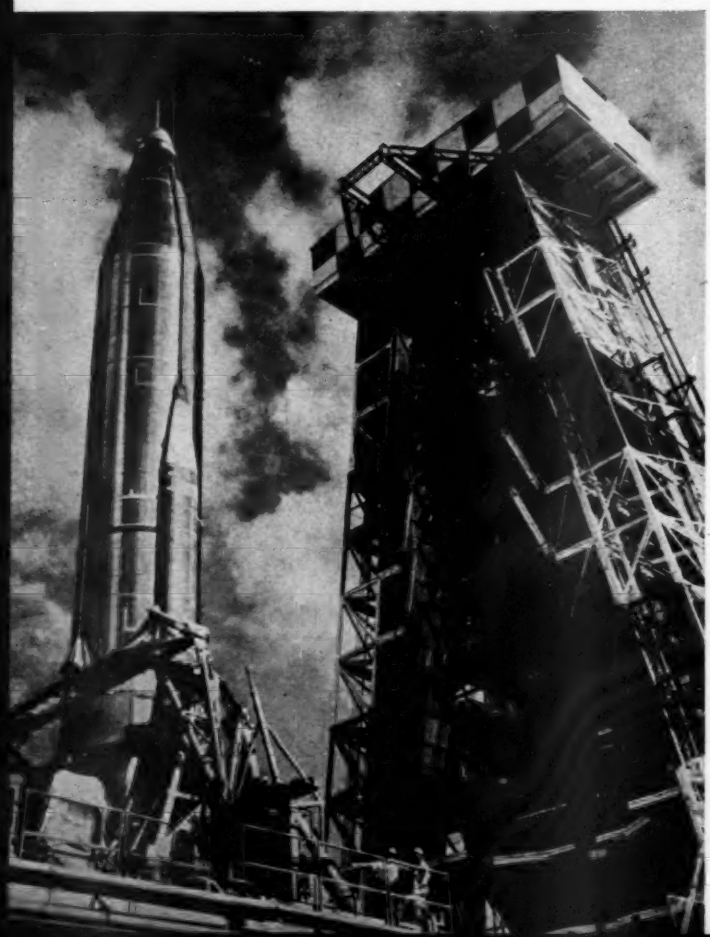
AT a small ceremony in Canada House on November 27, the High Commissioner received from Air Cdre. W. Wynter-Morgan of Armstrong Whitworth, two aircraft models for the new Canadian National Aviation Museum that is to be opened in Ottawa next year. These beautifully made 1/24-scale models were of a Siskin and an Atlas—aircraft which have played an important part in Canadian Service aviation.

In making the presentation of this splendid and generous gift, Air Cdre. Wynter-Morgan extended the apologies of Mr. H. M. Woodhams, the company's managing director, who was unable to be present. He spoke of the importance of next year to Canadian aviation—it would be the 50th anniversary of the first powered flight there. The inauguration of the new aviation museum was part of the commemoration of that event. A.W.A. had been asked to provide drawings from which models could be made for the museum; but the company had decided that they would make the models themselves and present them to Canada as their contribution to the Golden Jubilee.

The Hon. George Drew, Canadian High Commissioner, also referred to the importance of next year's celebrations. He spoke, too, of the close association between Canada and Great Britain. "For all time to come," he said, "the history of aviation will record that in no two countries has there been such close association, as between Great Britain and Canada, in flying and in building aircraft." He recalled some of the instances of this close association. It was vitally important, he went on, not only to integrate the human effort of the nations of the Commonwealth—we must integrate and use to the maximum capacity the production facilities in every part of the Commonwealth. There was a strategy of production just as there was a strategy of defence.

Foreign Airlines Luncheon

MR. HAROLD WATKINSON, Minister of Transport and Civil Aviation, was the guest of honour at the 12th annual luncheon of the Foreign Airlines Association in London on November 26. Mr. W. H. Whelan, of Aer Lingus, took the chair. The Minister made reference to the recent debate in the House of Lords on the proposed Air League Memorial



ATLAS ICBM.—First full-range firing of an Atlas was on November 28 over 6,235 miles from Cape Canaveral. This earlier Atlas on the test gantry has a rounded nose. The full-range Atlas fired last week had a pointed nose.

FREIGHTSHIP.—The first Dart-engined F-27B was recently delivered to Northern Consolidated Airlines in Alaska. This version is a mixed passenger/freighter with a special cargo-loading door measuring 90 in. by 72 in.; a movable front bulkhead and freight-carrying floor.

for London Airport and left his hearers to understand that the next move was up to the Air League.

Replying to Mr. Craden's tribute to Britain's pioneer work with Sir Frank Whittle's jet, Mr. Watkinson paid in his turn a tribute to B.O.A.C. and the de Havilland company that drew enthusiastic applause from those present. He spoke of peace resting on the peoples of the World getting to know each other more thoroughly and that mass travel above the weather in the new jets would aid towards this. The problems would be overcome. We were planning for an expanding future.

The luncheon was an extremely pleasant one and though, as Mr. Craden of Trans World Airlines had said in his speech, competition, and particularly British competition, was good for the airline business, the atmosphere was one of extreme good fellowship. The tone had been set by Mr. Christensen of S.A.S., who had concluded his address of welcome to the guests with a pleasant parable about the rheumatic centipede who took some advice from a mouse. Perhaps it was a fable rather than a parable; anyway the moral was not entirely clear, though it had something to do with policy and detail.

Mr. Christensen was followed by Sir Eric Harrison, the Australian High Commissioner, who was in tremendous form and gave his audience a highly personal account of the historic facts about the selection of the name Canberra for the federal capital. He enlarged on the romantic rise of Qantas from being a bush airline in the outback to its present international status and having offices in Piccadilly and New York.

Russian Nuclear Power Progress

A REPORT which originated in *Aviation Week* has yet to be confirmed. According to this, the Russians have again short-circuited Western research in producing an atomic-powered aircraft, but there seems to be some confusion between this revolutionary project and the Soviet supersonic bomber code-named Bounder. The nuclear-powered aircraft is said to have a 195-ft. fuselage with an extremely long nose to isolate the crew from high-intensity radiation, and short swept wings of some 75-ft. span, under which are slung four large jet units.

The two mounted at the tips are said to be conventional turbojets each of 35,000-lb. thrust, probably for use during take-off and landing, while the inner pair are apparently the nuclear units, each producing 70,000-lb. thrust. The direct air cycle technique, whereby a nuclear reactor is used between the compressor and turbine stages instead of conventional fuel combustion, is said to be employed in the aircraft, which is intended to have global range without the necessity of refuelling.

If the nuclear reactor is used only in the air, shielding may be confined largely to protecting the crew, and the weight penalty confined to a reasonable figure within the alleged 300,000 lb. total for the aircraft. And if the design really is a prototype for a high-speed bomber, the Russian lead in technology is truly remarkable. In contrast, the Americans have reached the stage of flying in a B-36 a reactor which is simply a dead load, and does not drive any propulsive machinery.

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Entertainment by Elstree

DISAPPOINTMENT that the British aircraft industry has not provided a cheap, mass-produced, simple and safe aircraft for the private flyer was expressed by GP. CAPT. C. A. B. WILCOCK, who is M.P. for Derby, N., and chairman of the Derby Aviation group of companies, on November 28. He was speaking at the annual dinner and dance of the Elstree Flying Club at Kingsbury, when about 120 members and guests assembled.

The industry, he continued, have received enough money from military orders—it is time that they produced the sort of light aircraft that is required. He was sorry that the club-flying movement had not made better progress—the aircraft of 40 years ago, when he began flying, were just as good as those of today. But there was some dissentient opinion when he said that the Sopwith Pup was better than the Chipmunk!

Gp. Capt. Wilcock was replying to the toast to "The Guests" proposed by DR. R. ATHERSTONE, the chairman of the club's social committee. In welcoming the presence of Gp. Capt. "Eustace" Miles, A.B.A.C. chairman, and Mr. C. M. Colbeck, controller of the M.T.C.A. Southern Division, Dr. Atherstone also marked the club's appreciation of the chief instructor and manager, David Ogilvy, who was "beating really safe aviation into us—and exacting fines for our shortcomings."

In one of his customary speeches, which have the merit of being both short and informative, MR. DAVID OGILVY proposed the toast to "The Members." The response was made by MR. ADRIAN ROSS, who, with amusing references, apologized for making his speech revolve around David Ogilvy—but that is just what the club does.

After dinner, members and guests danced until the early hours to the spirited music of The Debonaires.

Computers and Contrasts

INCREASING numbers of companies in the aircraft industry are moving into the electronic computer business. Most of these showed their newest designs at the Electronic Computer Exhibition held recently at Olympia.

In some cases the stands showed by their small size and limited content that the subject was a recent one so far as that company was concerned. Others had blossomed considerably since the company's electronics activities were shown before, elsewhere. In one notable case, that of Solartron, the main stand was insufficient to show all the exhibits, and a subsidiary stand contained the business machines.

Familiar aeronautical names were not hard to find. Air Trainers Link showed a model of the B.E.A. aircrew-training centre and a computer of the type used in flight simulators. The Fairey Aviation Co. had a multi-purpose analogue computer. The principal Saunders-Roe exhibit was a 20-amplifier

CARRIER BASED.—A new picture of the A3J Vigilante two-seat all-weather attack bomber outside North American's Columbus, Ohio, plant. It has two General Electric J79-2 turbojets of 15,000-lb. thrust each mounted on the sides of the fuselage.

analogue computer, set up as a nuclear reactor simulator, in addition to a Miniputer. A range of electronic components by Short Brothers and Harland included an analogue computer. A model of the Short SC.1 VTOL aeroplane was mounted on a rocking table to illustrate functional testing of gyro-control systems.

Many of the exhibitors at the S.B.A.C. Show with small stands here were very big guns indeed, although there was no hesitation in using missile models and aeroplane photographs. Among familiar names were those of B.T.H., Elliott Brothers (London), E.M.I. Electronics, English Electric, Ferranti, Mullard, Plessey, Solartron, Southern Instruments, Sperry and Standard Telephones and Cables. Generally, exhibits could be divided into two groups—those of business machines and those for performing intricate calculations.

The latter have found a permanent and increasing place in the aircraft and missile designers' inventory of technical tools; they are absolutely indispensable for the age of space travel now imminent.

Common Sense in Cornwall

RATHER more departmental consideration than has been shown over the closing of Croydon Airport has been given regarding the sale of Perranporth Aerodrome.

A few weeks ago the Cornish Gliding (and Flying) Club, the present tenant of Perranporth, was advised by the Air Ministry that the aerodrome was to be put up for sale by tender but that if the club could get substantial local support particular attention would be given to its desire to continue there.

The club has reason to be thankful to Mr. E. Milner-Haigh, of St. Ives, who agreed to make an offer for part of the aerodrome. To convince the Air Ministry of public interest in the aerodrome the club began an active campaign for further support, and it is an encouraging indication of the airmindedness of the Cornish community that there was considerable reaction in favour of the club. Nearly 5,000 people, mostly local, signed petition forms; letters of support came from the Lord Lieutenant and the High Sheriff. Members of Parliament active in urging acceptance of the club's project included Messrs. Frank Hayman (Camborne-Redruth), Geoffrey Wilson (Truro), Frank Beswick (Uxbridge), and Sir Roger Conant, Bt. (Stamford and Rutland). Many local authorities throughout the country gave their full backing, as, of course, did the bodies officially concerned with private flying in this country.

The result is that Mr. Milner-Haigh has been successful in his tender, and will let the club have the use of the runways and certain grass areas at a low rental, while guaranteeing full consideration to present tenant farmers.

It is good to record this evidence that the Government does recognize that the air does not belong exclusively to certain privileged aviation interests.

Institutional Responsibilities

IN the course of his presidential address to the British Institution of Radio Engineers on November 26, Professor E. E. Zepler, Ph.D., who holds the chair of electronics at Southampton University, spoke of professional responsibilities. He pointed out that the true function of a professional body does not lie in its being a means of securing qualifications.

"Members of an institution should never forget that its prime object is to advance science and knowledge. Monthly meetings, conventions, group activities and publications should be regarded as means of post-graduate education. From such meetings and proceedings there is always something new to learn. It is the function of such an institution to ensure that membership comprises the type of engineer who is eager and able to learn and willing to exchange knowledge."

Louis Massey Hilton

WITH deep regret we record that Mr. Louis Massey Hilton, D.F.C., A.F.C., A.F.R.Ae.S., died at his home at White Hermitage, Old Windsor, on November 29. It was only at the beginning of this year, as reported in our issue of February 14, that he retired, through ill health, from the board of the Fairey Aviation Co., Ltd., with which company he had been associated since 1931.

Learning to fly with the R.N.A.S. in 1917, he was ever after in close connection with naval flying, working with seaplanes and aircraft carriers, until 1927, when he became Air Staff Officer with H.Q., Coastal Area. His first real association with land-going aircraft was in 1930, when he became a flight commander with No. 41 (Fighter) Squadron.

In 1934, Massey Hilton was elected to the Fairey board. After that, as technical director, he was concerned with Admiralty liaison matters and played a prominent part in founding the company's Australian and Canadian subsidiaries.

He was elected a liveryman of the Worshipful Company of Coachmakers and Coach Harness Makers of London in 1949.

WARTON VISIT.—Air Chief Marshal Sir Claude Pelly, Controller of Aircraft at M.o.S., visited English Electric on November 12. Here (left to right), are Mr. H. G. Nelson, Sir Claude Pelly, Mr. F. E. Roe, Mr. F. W. Page and Lord Caldecote.

THOR WITH THE R.A.F.

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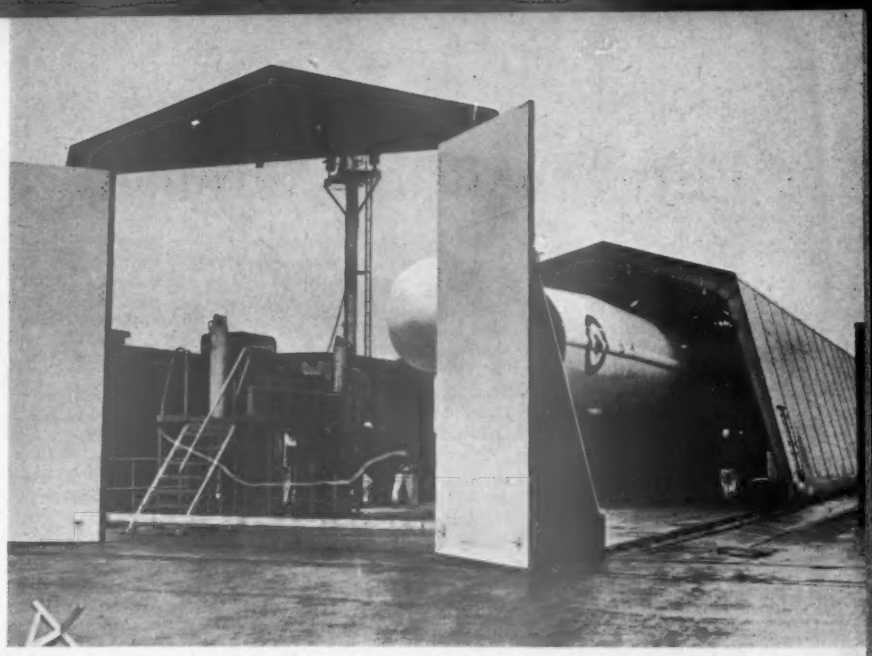
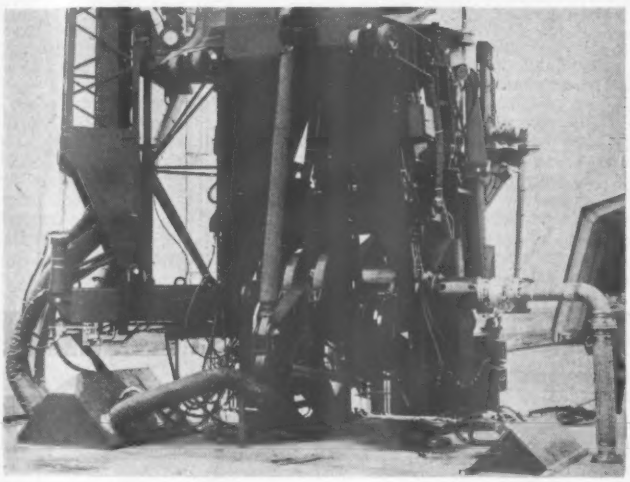
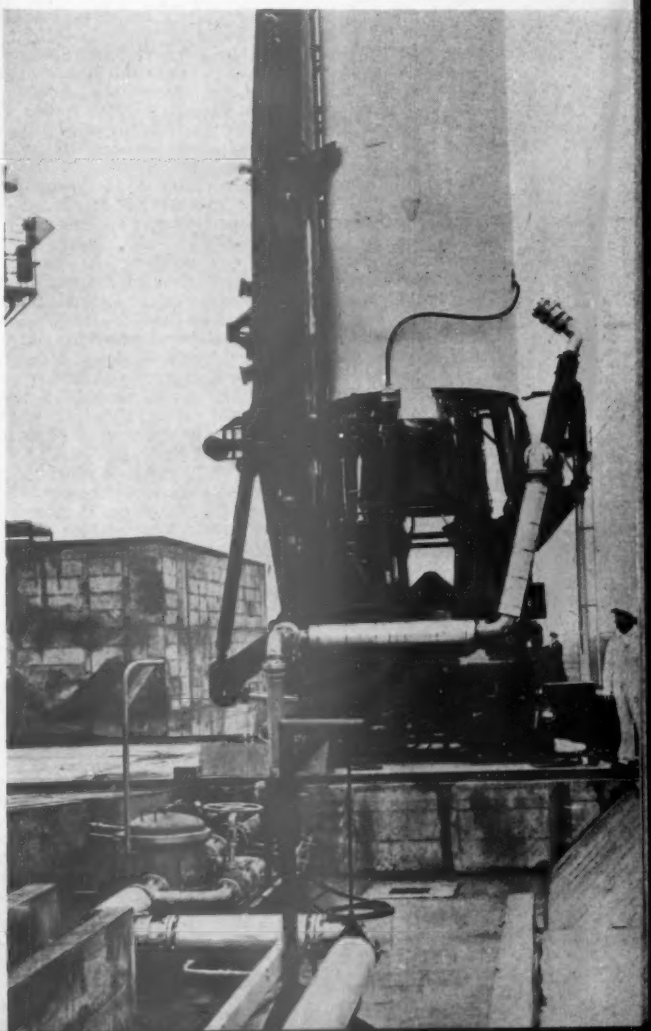




At Thor IRBM launching sites at R.A.F. Feltwell, the missiles are "stored" horizontally in individual hangars. Prior to firing, the hangar is moved clear of the missile on rails, leaving the Thor exposed and ready to be raised to the firing position.

The close-up below shows the base of the missile and its exhaust nozzle—beneath which is the efflux deflector cone. The valve gear in the foreground and the ducting up to the missile are part of the fuelling system.



Above, this close-up of the launch-pad structure shows the lever system used to raise the missile to the vertical firing position. Below, a general view of one of the Thor launching sites.

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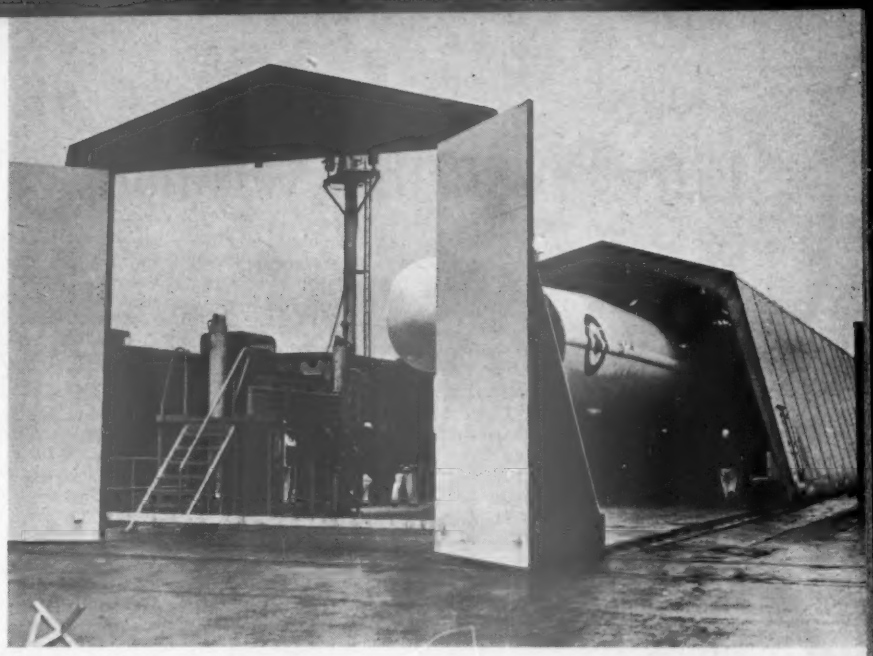

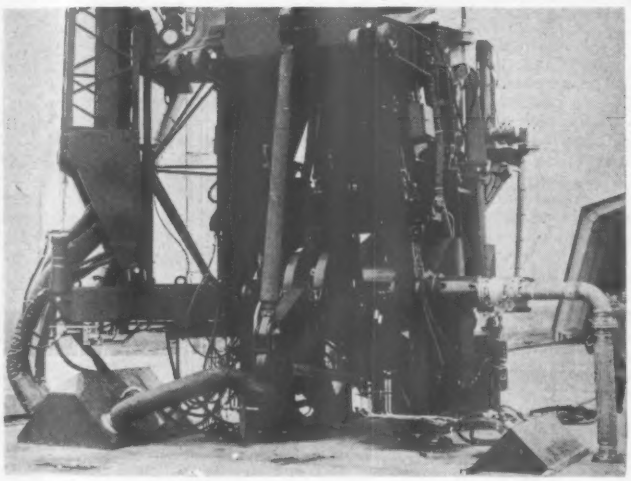

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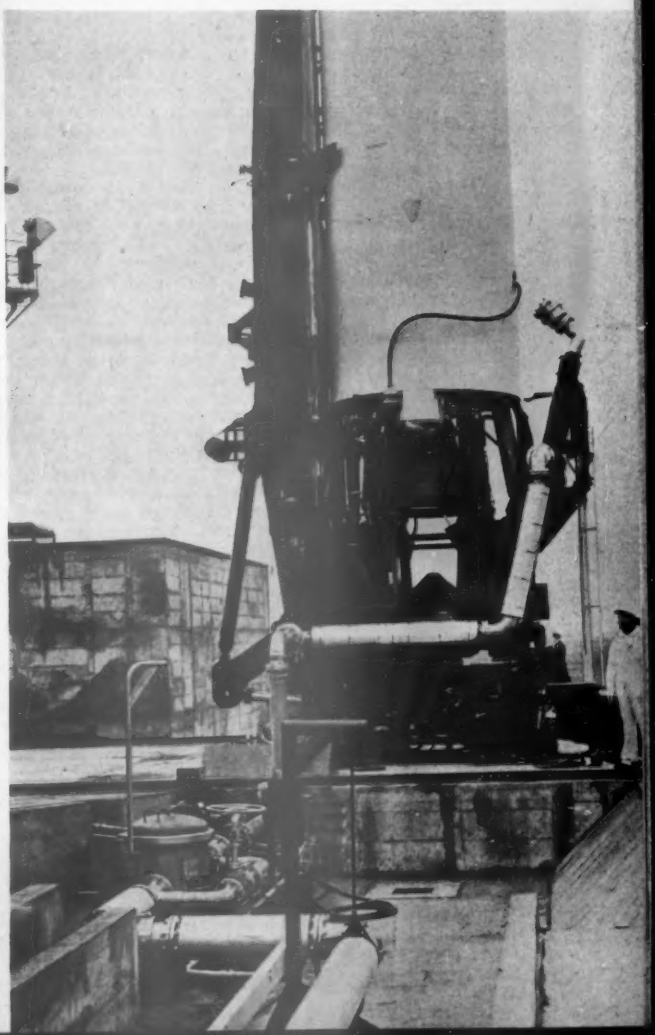

Fifty Years of Aeronautical Development

DELIVERING the second of the three Cantor lectures, "The Development of the Aeroplane," to the Royal Society of Arts on December 1 in London, Mr. Peter W. Brooks, B.Sc.(Eng.), A.C.G.I., A.F.R.Ae.S., succeeded in presenting an admirable summary of 50 years of aeronautical development in aircraft layout, structural design and powerplant form—in a talk lasting as many minutes. In the allotted time he could deal with no more than a fraction of the material contained in his excellent written paper. But his consequent "off-the-cuff" discussion of selected illustrations was much enjoyed and appreciated by an audience which included a number of well-known aeronautical engineers.

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Perhaps the most striking advance made during the past 50 years is in maximum speed; instead of the 40 m.p.h. of the Wright Flyer and its contemporaries—about the average cruising speed of a modern family car—the modern light aeroplane cruises at a speed approaching 200 m.p.h., the commercial transport at about 85% of the speed of sound, while the highest performance military aircraft can fly at more than double the speed of sound.

A large part of this spectacular progress has taken place during only the past 12 years. A plot of World speed records prepared by Mr. Brooks shows that there was steady progress in the period 1908-1944 which raised the record to about 470 m.p.h. with an average increase of about 12 m.p.h. per year. However, since 1945, with the appearance of jet propulsion, the record has risen to over 1,400 m.p.h. in only 13 years—an average rate of increase of 72 m.p.h. a year! Actually, this is not the whole story because rocket research aircraft have achieved still higher speeds, although not as records.

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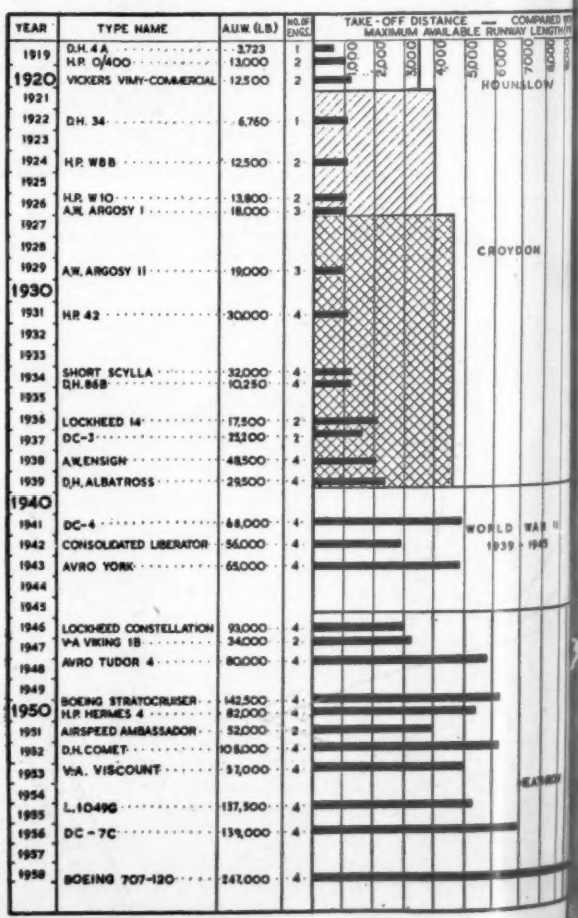

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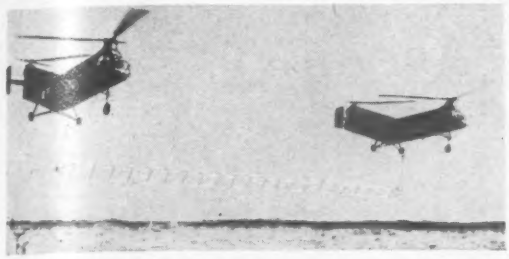

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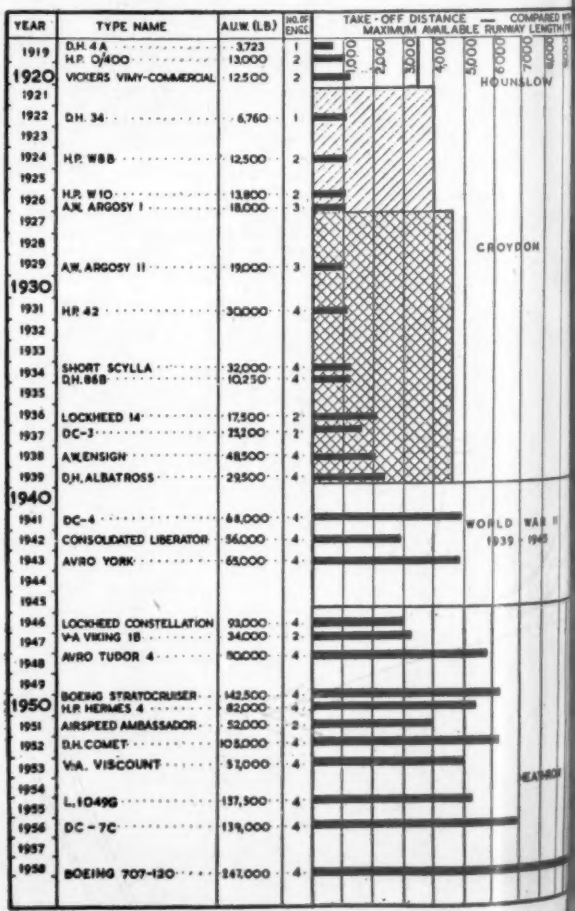

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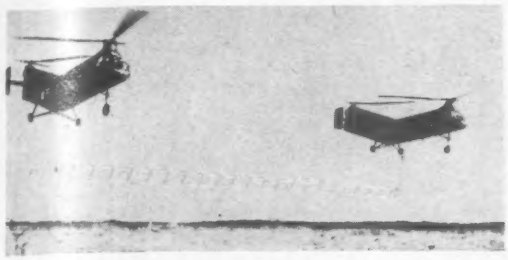

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Air Transport

IFALPA in Action

BOTH before and since the collision on October 22 between a B.E.A. Viscount and a military aircraft near Anzio there have been complaints about the standards of air traffic control over Italy and, indeed, over several areas in the Mediterranean region.

Since 1951 several serious incidents in these south and south-east areas of Europe had, apparently, been reported by members of the organizations affiliated within the International Federation of Air Line Pilots' Associations. This Federation had, in that year, approved a resolution criticizing certain air traffic control authorities in Europe. So it was not unnatural—though no less a forthright and vigorous action—for IFALPA, in the person of its executive secretary, Capt. C. C. Jackson, to have discussed, early last week in Rome, the various problems involved with the Italian Under-Secretary of State for Civil Aviation. The Under-Secretary, Senator Giuseppe Caron, gave an outline of a programme of improvements.

This programme is given in detail below, but it involves developments not only in Italy, but in Europe generally, with improvements in the radio/radar facilities and with measures to reduce the amount of military flying in terminal areas and to separate the movements of military and civil aircraft.

The A.T.C. system will, however, remain in the hands of the military authorities, who will be solely responsible, through the Telecommunications General Inspection Office, for all control. This is, maybe, the least satisfactory feature of the "new look" for Italy's A.T.C., but there is no obvious reason why the system should not be as well organized by the military as by anyone else—and pilot's reports will continue to be available as a means of checking the improvements shown by the new programme.

Meanwhile, IFALPA, at the request of Senator Caron, is to create a special committee to provide technical suggestions for any further improvements in the plan, and positive results will be reported to the Federation's annual meeting in Helsinki during March, 1959.

The idea is that the essential features of the programme will be completed before mid-1960. Obviously there is a new mood in Italy and it is an excellent thing that a major nation should, in this way, be prepared to admit the inadequacy of its A.T.C. system to meet present-day demands and is prepared, also, to remedy the situation. It is to be hoped—as IFALPA itself remarks—that progress in Italy during the next 12 months will be noted by other Mediterranean countries.

The details of the Italian programme are as follows:—

(1) The Control of the Airspace

(a) The Military Authority will be solely entrusted with the control of commercial and military flights over the whole national territory, through the Telecommunications General Inspection Office.

(b) Active steps will be taken towards the establishment of a European Air Traffic Control Agency as between the six countries of the Common Market.

(2) Radio Aids Programme

(a) Installation of surveillance-radar at Rome and Milan; in this connection negotiations for the purchase of the equipment are already proceeding.

(b) Meanwhile the military radar network will be employed for monitoring both civil and military operations, particularly in the Rome and Milan areas.

(c) The European plan of the International Civil Aviation Organization for a VOR network will be implemented with the aid of experts from the American Civil Aviation Administration, who are already in Italy. The programme includes the completion of five stations (now in an advanced state of construction), besides the six already existing. They will be followed by seven others, thus bringing the total up to 18 VOR stations.

(d) Speedy installations of ILS and GCA at the principal air terminals, in accordance with the ICAO plan for Europe.

(3) Military Traffic

(a) The Chief of Staff is examining all measures which can provide for a reduction of military flights in Rome and Milan terminal areas.

(b) No violation of the rigid regulations on the interception of civil aircraft will be tolerated. In this regard the most strict orders have been issued for absolute flight discipline.

(4) Separation of Civil and Military Requirements

The separation of civil and military aviation, already decided upon, will provide an accelerated reinforcement of all branches of the Italian civil aviation industry, with resulting advantages also in the field of air traffic control. Although this control will remain under the responsibility of the Italian Air Force, it is expected that the management and efficiency of the control itself will be improved in that it will be financed by, and under agreement with, the High Commission for Civil Aviation.

Independent Relationships

THE report, given background in last week's issue, of Airwork's interest in Morton Air Services and Olley Air Service is of importance not only because these two already interdependent operators must eventually make a move from their present base at Croydon—and can only, it seems, go to Gatwick, whence another Airwork subsidiary, Transair, is already operating—but because it is another sign of consolidation among the independent airlines.

Several years ago those watching the affairs of the British airline operating business found themselves waiting for history to repeat itself with an overall merger trend similar to that shown with the formation of British Airways in 1935. A third, free-enterprise, corporation had seemed to be a logical denouement in the solution of the problems faced by the independents in a restricted environment.

But no merger developed; the different companies tended to continue to play a sometimes rough game of musical chairs while retaining—after a period during which shipping companies took an interest in some of the larger organizations—their individual identities. At present, not counting those doing specialist work, a score or more of operators remain in active

(*Continued on page* 817)

INTERCONTINENTAL ROLL-OUT.—First of the Boeing 707-320 Intercontinentals—destined eventually for service with P.A.W.A.—is seen here on the flight apron at Renton after roll-out on November 24. Larger and heavier than the 707-120, it is the first of the Boeings powered by 15,800 lb. s.t. Pratt and Whitney JT-4A turbojets. Flight tests were also due to begin last week with the first JT-4A powered DC-8; this will be the second DC-8 flown, and is the airframe which has been used for static testing

(*Continued from page* 816)

and largely independent existence in spite of a fairly steady succession of purchases, mergers and infiltrations.

In a later issue we hope to provide a detailed tabulation of current ownerships and relationships of the different British carriers, but now, since changes have recently been in the news, it will be helpful to offer an outline of the present position.

By way of a start it could be explained that four of the independent carriers—all major operators—have substantial shipping shareholdings. These companies are Airwork, Ltd., British Aviation Services, Ltd., Hunting-Clan Air Transport, Ltd., and Skyways, Ltd. Two—Airlines (Jersey), Ltd., and Cambrian Airways, Ltd.—have, during the past year, sold relatively large proportions of their respective shareholdings to British European Airways, thus becoming "associates" in more than the formal sense demanded by the Government when scheduled services are operated; such services are still legally the sole prerogative of the nationalized airline corporations. So let us look at these six carriers in alphabetical order.

The capital of Airlines (Jersey), Ltd.—better known as Jersey Airlines—is owned by the Jersey Airlines Development Corporation, Ltd., and B.E.A. now holds 25% of the shares in this company.

Furness, Withy and Co., Ltd., and the Blue Star Line, Ltd., together hold a minority, but substantial, shareholding in Airwork, Ltd. A majority is held by Mr. T. L. E. B. Guinness and the Whitehall Securities Corporation, Ltd. Airwork associates now include Fison-Airwork, Ltd., Aviation Traders, Ltd., and Air Charter, Ltd., which was acquired by Aviation Traders in 1952. Subsidiaries include Transair, Ltd., Straits Air Freight Express (in New Zealand) and now, it is understood, Morton Air Services, Ltd., and Olley Air Service, Ltd. Olley was formed in 1933, so there is sentimental comfort to be gained from the fact that Airwork began its active life even earlier—in 1928.

The P. & O. shipping group have a major holding in British Aviation Services, Ltd., which is best known outside the aviation business by the name of one of its operating subsidiaries, Silver City Airways, Ltd. Other shareholders are Cable and Wireless (Holdings), Ltd., and the Eagle Star Insurance Co., Ltd. In addition to Silver City, B.A.S.'s subsidiaries include Britavia, Ltd., which is primarily a trooping and charter operator. In the course of its development B.A.S. has taken over Manx Airlines, Ltd., and its associate Manx Aero Engineering, Ltd., the Lancashire Aircraft Corporation, Aquila Airways, Ltd. (which ceased flying-boat operations at the end of the holiday season this year), Air Kruise, Ltd., and Dragon Airways, Ltd. The work of most of these extinct operators is now continued under the Silver City name; the name of Lancashire Aircraft Corporation has, however, been re-acquired by Samlesbury Engineering, Ltd., in connection with their purchase of Edgar Percival Aircraft, Ltd.

In February, this year, B.E.A. took over 33% of the shares of Cambrian Airways, Ltd., which was formed in 1936.

Originally known as Hunting Air Travel (when formed as the first of the post-War independents in 1945) and later as Hunting Air Transport, Hunting-Clan Air Transport, Ltd., was formed when Clan Line Steamers (now part of British and Commonwealth Shipping) came into the aviation business. The company is a subsidiary of Hunting-Clan Air Holdings, Ltd., which, in turn, is owned in equal proportions by the Hunting Group and Clan Line Steamers. Excluding many wider Hunting interests in aviation and otherwise, the companies in the H.-C.A. Holdings orbit are Field Aircraft Services, Ltd., and its overseas associates, Fieldair, Ltd., Hunting-Clan African Airways (Pvt.), Ltd., and the Central African Air Supply Co. (Pvt.), Ltd.

The Bibby Line has a major interest in Skyways, Ltd., the last of these half-dozen British air carriers with maritime or State airline corporation support. The history of Skyways is a complicated one. It was originally formed in 1929 and was a very active operator during post-War years when, using DC-4s, it also helped B.O.A.C. out with certain scheduled services in the Middle East. It was purchased by the Lancashire Aircraft Corporation in 1952 and, though L.A.C. was later bought by British Aircraft Services, Skyways has remained as a separate name and organization.

Meanwhile, Eagle Aviation, Ltd.—and its subsidiaries, Eagle Airways, Ltd., Eagle Aircraft Services, Ltd., and Eagle Airways (Bermuda), Ltd.—with half a dozen other small units and combinations, remain as still vigorous and independent entities in this apparently bleak environment with opportunities which appear, to the outsider, to be so comparatively limited.

There is a lesson here, surely, for the politicians and administrators.—H.A.T.

Canadian Airports Policy

A NEW policy for the development and financing of Canada's civil airports has been announced by the Minister of Transport. It is intended to ensure adequate Government backing for the construction and expansion of both major airports and local airfields.

At any airport used by scheduled services, the Department of Transport will continue to be wholly responsible for runways, tarmacs, lighting systems and aids to navigation. In future, however, the Federal Government will require title to the land to be vested in it before such work is initiated; the land will be leased back to the local municipality for a nominal sum in those cases where it is desirable to have the airport municipally-owned.

In the case of smaller, specialized fields, new arrangements will also apply. Development airstrips, which may be required for the opening up of some natural resources, will either be financed wholly by the D.o.T. if the project is of national benefit; or jointly with the private corporation, province or municipality concerned, in which case the D.o.T. will contribute up to $100,000. Remote area fields, which are essential for transportation services to communities "periodically deprived of surface transport media," will be constructed by the D.o.T. at a cost of up to $50,000, providing a local authority first acquires the land and transfers the title to the Government. The operation of such airfields would also be the responsibility of the local authority.

Grants of up to $100,000 will also be made by the Government towards the cost of non-essential but useful airfields established by local authorities, and of principal benefit to flying training, private flying and charter and executive operations. The D.o.T. will not normally be responsible for buildings of any kind at the smaller fields, but will provide airport terminal buildings at Government-owned airports and will make a grant towards the terminal buildings at municipally-owned airports.

B.E.A.'s Improving Results

TRAFFIC results of B.E.A. in September continued to show the general pattern of the summer, with only a small increase in load ton-miles sold and a reduction in revenue load factor. In October, however, there were heartening indications for the Corporation that the easing of credit restrictions has led to a resumption of the more normal rate of growth of air travel. The recovery, writes Lord Douglas in the *B.E.A. Magazine*, if it really is maintained, emphasizes once again that short-term fluctuations in trade must not be allowed to influence the airline's policy of controlled expansion. If these present trends continue, it seems that B.E.A. may still be able to show a small profit in the current financial year.

Progress can be recorded on the domestic trunk routes, following the introduction of the cheap week-end fares on November 1. Traffic has increased sharply and forward bookings are excellent. The September results are tabulated below:—

	September 1958	September 1957	Variation
Capacity ton miles offered ..	19,421,200	17,301,700	+12.3%
Load ton miles sold	12,497,800	12,178,800	+ 2.6%
Revenue load factor	64.4%	70.4%	− 8.5%
Passengers carried	331,937	338,487	− 1.9%
Passenger miles flown	118,035,000	116,599,000	+ 1.2%
Passenger load factor	68.4%	77.1%	−11.3%
Freight ton miles	993,400	841,500	+18.1%
Mail ton miles	322,350	2 7,500	+20.5%
Aircraft miles flown	3,837,000	3,618,000	+ 6.1%
Revenue hours flown	20,808	20,733	+ 0.4%

FRENCH TRIAL.—This Vertol 44, with floatation gear similar to that used by New York Airways' fleet, was used for an experimental service between Caen and Le Havre during the summer. Some details of the results obtained are given on this page.

A Helicopter Experiment

AN experimental scheduled helicopter service was operated in France for five weeks during the summer, with some interesting results. The service was flown between Caen and Le Havre with four intermediate stops, and a 15-seat Vertol 44 operated three round trips every day on this route. Two subsidiaries of Société Générale des Transports Départementaux, coach operators of Paris, arranged the service: Les Couriers Normands and Compagnie Normande d'Autobus. British associate of this group of companies is Instone Air Transport, Ltd., the well-known air brokers.

The helicopter service operated from July 25 to August 31, during which time there were 110 return flights, plus five return flights from Le Havre to Deauville and four ad hoc return flights. Regularity and punctuality were "almost 100%."

Ignoring the ad hoc flights, the service carried 3,332 passengers and the total distance covered was 15,120 km. (9,395 miles). The average distance flown per passenger was 33.4 km. (20.7 miles) and the scheduled services completed 111,193 passenger-km. (69,091 passenger-miles). Over the entire period passenger load factor averaged 52.2%; the factor rose from 40.7% in the first week to 61.4% in the last fortnight.

The fare for the Caen-Le Havre journey, a distance of 67.5 km. (42 miles) was fr. 5,000 single and fr. 9,000 return, which works out at 119 fr./mile (about 2s./mile at the current rate of exchange). The operation could have broken even with 100% load factors, but was not undertaken with a view to making a profit; rather, it was intended to study the reaction to helicopters rather than coach transportation in the area, and to study the operational problems of such a service.

Postscript to the Airlines Number

SINCE going to press with our annual Airlines of the World number (November 7) we have received one or two late replies in addition to those summarized on p. 673 of the issue concerned.

First, however, it would be as well, for the benefit of those who keep the issue for reference during the year, to correct an error caused by the accidental transposition and repetition of lines in the part of the guide section dealing with the present and future fleet of Swissair (p. 701, column three). The sentences concerned should have read:

"At mid-1958, the fleet consisted of four DC-7Cs, seven DC-6Bs, three DC-4s, eight DC-3s and 11 Convair 440s. One DC-6A Cargoliner has since been delivered, and three DC-8s, five Convair 880s and one DC-7C are on order."

A correspondent in Switzerland has written to say that one of the three DC-4s has now been sold and delivered and that the remaining two should have been sold by the spring of 1959. The fifth DC-7C has recently been delivered.

From Rio de Janeiro, Brazil, Serviços Aéreos Cruzeiro do Sul S.A. have written to give their traffic figures for 1957 (which we published from IATA sources) and the present list of directors. The letter includes information to the effect that Cruzeiro is a major shareholder in Transportes Aéreos Caterinenses S.A., and in S.A. Viacão Aérea Gaúcha (SAVAG); the three companies operate mutual services. Arrangements were, in fact, made in 1950 and 1951 respectively for the supply by Cruzeiro of engineering facilities and flight crews for the operations of both TACSA and SAVAG. The Cruzeiro fleet consists of three Convair 440s, four 340s and 10 240s, 30 DC-3s, seven Fairchild C-82s and four Beechcraft AT-11s (for aerial photography).

Cruzeiro figures for 1957, in addition to those already given in the table, are: Employees, 3,794 and flight captains, 194.

ON TOUR.—Lockheed's Electra demonstrator seen at Gatwick last month and, right, the AiResearch compressor starter which was specially fitted for the tour. Introduction of the Electra into service, scheduled for December 1, has been jeopardized by the strike of Eastern Air Lines' mechanics.

Photographs copyright "The Aeroplane"

Fuelling Developments at London Airport

EVEN to the non-specialist a few figures and the briefest of reflection will make evident the large scale of the problem of refuelling airliners at London Airport. Shell and the British Petroleum Groups are able to claim that four out of every five airliners using L.A.P. are flying on gasoline or turbine fuel supplied by Shell-Mex and B.P., Ltd., which concern fuels the individual aircraft. When in 1952 the D.H. Comet came on the scene 6,000 gallons had to be put in that airliner at a time. The Bristol Britannia has a capacity of 8,750 gallons. The Comet 4 needs 8,990 gallons. The Boeing 707 takes 15,000 gallons at a gulp.

In such circumstances it is easy to understand that in servicing 92,000 aircraft in 1957, Shell-Mex and B.P. supplied 36 million gallons of fuel. During the 1958 holiday peak almost 200,000 gallons were pumped into airliners on one day; that is about 140 gallons per minute throughout the 24 hr. As hitherto all this fuel has had to be brought in by road, it is not hard to understand that at peak periods more than 50 "bridging" tankers of 4,000-gallons capacity each have to be brought into L.A.P. each day. And the demand is rising steeply. The answer must be a pipeline, or pipelines, and in the end a hydrant-refuelling system for the aircraft.

On November 26 Mr. Airey Neave, Joint Parliamentary Secretary, M.T.C.A., opened the new Shell-Mex and B.P. plant at London Airport by turning a valve. Mr. Vignoles, managing director of the company (right) and Mr J. R. Grant, the company's airport manager, looks on.

Use of radio telephony ensures the maximum efficiency of the plant and tankers. The nerve-centre is the operations room (above). From here the duty movement controller can speak to any of the major airlines, to his own crews and foremen. A moving tape announces the movements of every airliner, coming and going.

On November 26 the first stage in such a scheme was marked by an official ceremony in the Perry Oaks Depot of Shell-Mex and B.P. at London Airport when a valve was turned by Mr. Airey Neave, Joint Parliamentary Secretary to the Ministry of Transport and Civil Aviation. This depot has been built on the west side of the airfield.

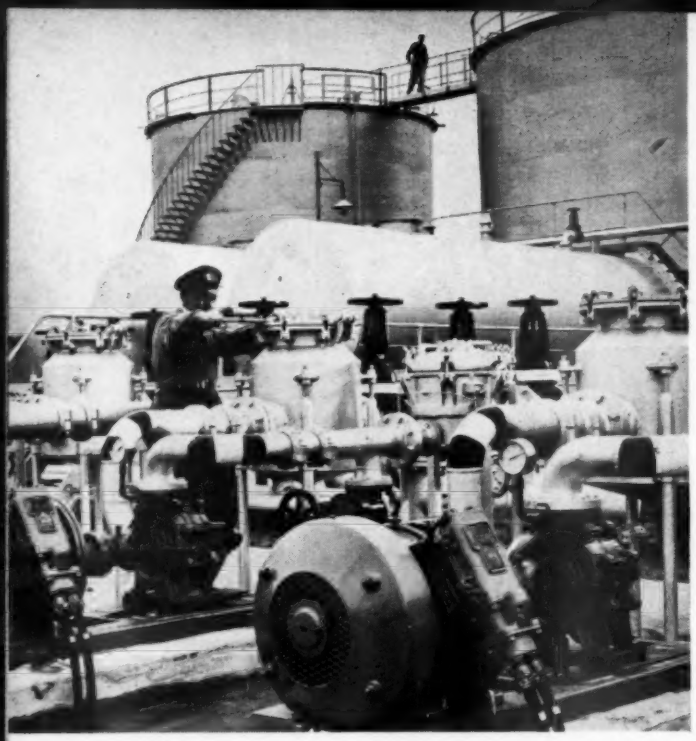
Here are a number of storage tanks, four vertical, the biggest holding more than 150,000 gallons and eight smaller horizontal tanks. All tanks have an automatic floating suction device to ensure that fuel is only drawn from the top layer. Ten electrically driven centrifugal pumps have been installed on an open pump platform. The layout is capable of moving 350 gallons per minute.

From Perry Oaks Depot the fuel is pumped through segregated pipelines, under two main runways and into the large new central depot in the central area. Here are 12 horizontal storage tanks for both turbine fuel and aviation spirit. The fuelling vehicles drive up to a large covered gantry. The driver presses a button and one of six remotely controlled electric self-priming pumps fills the vehicle with the grade required at 250 gallons a minute. Each load is automatically metered and recorded.

There is also a lubricating oil loading bay stocking two grades of aviation lubricants. These are stored in underground tanks, and loaded into the delivery vehicles by pumps inside the tanks, remotely controlled at the filling point. There is also a stainless-steel tank for storing methanol mixture.

Additional provision is planned for aviation turbine fuel, by the installation of underground rectangular tanks to raise storage capacity from 150,000 to 550,000 gallons. A de-mineralized water plant is being constructed to provide pure water for the special booster take-off equipment of the big jet airliners now coming into service.

There are vehicle maintenance and repair bays, equipped



At the Perry Oaks Depot there are ten electrically driven centrifugal pumps able to supply the pipelines to the central area.

with pressure washing and greasing facilities, and an inspection pit with recessed lighting.

The two-storey administrative block has an operations room which is the nerve-centre of the company's fuelling control system. A 12-channel communication unit puts the duty movement controller in instant communication with all the major airlines at the flick of a key. He is advised by ticker tape of airliners due to land so that fuelling vehicles can be directed by radio to the points where their services will be needed.

The office block is of modular design with glazed external walls. All offices are sound-proofed and have ample natural lighting. The crew room for the operational staff and a general office are on the ground floor. Other accommodation includes a workshop and supervisor's offices. The operations manager's office is on the first floor, where there is also a mess room, a drying room and a heated locker room.

The depot in the maintenance area of the airport, which is supplied direct by "bridging" vehicles from the Thames refineries and storages, has 14 horizontal tanks and a gantry with eight "push-button" filling points. Five more tanks are being installed to increase the storage available for aviation turbine fuel.

The pump house contains eight electrically operated pumps capable of loading fuelling vehicles at a rate of 250-300 gallons a minute. The big 4,000-gallon bridging tankers can be discharged in 20 minutes. The layout of the depot enables them to drive in and drive out without reversing. As in other depots the pumps and the gantry outlets are painted in standard colour codes to obviate any risk of grades being confused.

All fuelling operations are supervised by the fuelling foreman, whose motorcycle combination is provided with a radio telephone.

Two 12,000-gallon compartmented tanks are set aside for the two main grades of aviation lubricants stocked, and there are also pumps for handling them.

Behind the main tank compound is a long glass-covered annex in which the aircraft fuelling hoses are stored fully extended on special racking. There is also a combined store for low flash material such as methanol mixture, special products and packed lubricants.

The whole of the Shell-Mex and B.P. fleet of aircraft fuelling vehicles working on the airport is serviced and maintained at this depot. There are three maintenance bays for pressure washing and greasing and minor repairs.

Here too there is a two-storey office block which contains supervisor's office and crew quarters. There is a mess room and a drying room with heated lockers.

The next step is to link the Perry Oaks Depot by pipeline to Walton-on-Thames whence supplies can be drawn by existing pipelines from refineries on the Thames Estuary. In the near future Parliamentary sanction is to be obtained for a Private Bill to sanction the building of pipelines between these two points.

Welcoming Mr. Airey Neave at the official luncheon, Mr. C. M. Vignoles, managing director, Shell-Mex and B.P., Ltd., said:

"With the advent of the bigger jet airliner the demand for fuel will go on rising sharply. By 1962 we expect it to be just over twice the present figure, and by 1966 more than three times. To maintain a sufficient stock on the airport to provide

PERRY OAKS DEPOT
FEEDING CENTRAL AREA BY BURIED PIPELINES
CENTRAL AREA DEPOT
MAINTENANCE AREA DEPOT
SHELL MEX AND B P LTD
DEPOTS AT LONDON AIRPORT

This annotated aerial photograph of L.A.P. shows the layout of the Shell-Mex and B.P. depots there.

for consumption of this order we should need to have no fewer than 150 4,000-gallon bridging tankers delivering at the airport every day during the summer peak periods, with the attendant congestion of road traffic both inside and outside the airport.

"To overcome this obvious disadvantage our main storage tanks could be replenished by pipeline. We intend to seek the sanction of Parliament to a Private Bill which, if passed, will permit us to build two six-inch pipelines to bring fuel into the airport from storage eight miles away at Walton-on-Thames.

"On the airport itself we shall undoubtedly need some kind of hydrant system to enable airliners to pull in and be filled up rather like motorcars at a roadside service station. But this ultimate development cannot be planned in any detail until a good deal more is known about the handling of big jet aircraft on the ground, and until a parking pattern governing the whole operation of the hydrant method of fuelling is decided upon and likely to remain undisturbed for some years."

The Fighting Services

Fleet Air Arm

REAR-ADMIRAL E. MILL, O.B.E., is to become Director-General, Aircraft, in succession to Rear-Admiral J. P. W. Furse, C.B., O.B.E., with effect from March, 1959. Rear-Admiral Mill became Superintendent of the Royal Naval Aircraft Yard at Belfast in February, 1954, and from the spring of 1957 until September, 1958, was Fleet Engineer Officer on the staff of the Commander-in-Chief, Mediterranean.

Since 1955 Rear-Admiral Furse has been successively Director of Aircraft Maintenance and Repair, Director-General of the Department of Air Material, and Director-General, Aircraft.

R.A.F. Athletics

AT the recent annual general meeting of the R.A.F. Athletic Association, at which its chairman, Air Cdre. H. Ford, presided, the view was expressed that the past season was one of achievement for R.A.F. athletics. The most satisfactory success was the consolidation of the new events introduced during the 1956-57 season.

Some 1,200 personnel from 97 stations competed in the 1958 summer inter-station athletics championships in 14 different area matches; the winter cross-country championships drew nearly 700 entries from 105 stations; and 100 road-walking enthusiasts took part in both winter and summer contests. Five hundred athletes, including 100 of the W.R.A.F., contested the inter-command and individual athletics championships, and increased interest was shown in the comparatively newly established marathon and decathlon championships, with the standard markedly higher in the latter.

In 1958 R.A.F. track and field competition produced very high-standard performances and new R.A.F. and W.R.A.F. records. These were in the R.A.F. 880 yd., 440 yd. hurdles, the mile and three miles, the inter-command and inter-station relays, the javelin and the high jump, and in the W.R.A.F. 440 yd. and discus. Technical Training Command regained the R.A.F. inter-command championship and its women retained the W.R.A.F. title. In the inter-station competition R.A.F. Acklington won the Air Council Cup for Division I and R.A.F. Halton the King's Cup for Division II. The marathon went to Warrant Officer E. W. Harrison, R.A.F., Cranwell.

The R.A.F. scored its fifth consecutive inter-services triumph, decisively defeating the Army by 44 points (165-121), the widest margin ever by a winning Air Force team, and the W.R.A.F. captured the inter-service athletics championship for the 9th year, defeating the W.R.A.C. by 3½ points.

Norwegian Campaign

TO COMMEMORATE the R.A.F. part in the Norwegian Campaign of 1940, wall plaque reproductions of the badges of the two squadrons—No. 263, flying Gladiators, and No. 46, with Hurricanes—which operated from Royal Norwegian Air Force Bardufoss, have been presented to the station. The plaques were handed to Lt.-Gen. B. F. Motzfeldt, C.-in-C., R.No.A.F., by Air Chief Marshal Sir Thomas Pike, A.O.C.-in-C., Fighter Command, during a recent visit by the Norwegian Commander-in-Chief to Command Headquarters.

Fighter operations in Norway were in two phases. No. 263 Squadron, commanded by Sqn. Ldr. J. W. Donaldson, spent a few days at the end of April, 1940, flying from the frozen Lake Lesjaskog, in Central Norway, but had to leave after suffering heavily from enemy bombing. Re-equipped with a new supply of Gladiators and followed a few days later by No. 46 Squadron, commanded by Sqn. Ldr. K. B. B. Cross, No. 263 Squadron flew in to Bardufoss from aircraft carriers and for about two weeks gave air cover to the British Forces.

On June 7 orders were given to evacuate and the aircraft landed on H.M.S. "Glorious"—the first time that Hurricanes had landed on an aircraft carrier. Next day the carrier was sunk by the "Scharnhorst" and "Gneisenau," and all but two of the squadron pilots were lost.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Group Captains: H. H. S. Brown, A.F.C., to the Institute of Aviation Medicine, in charge of Aero Medical Training; F. D. Campbell to Headquarters, No. 24 Group, as Senior Medical Officer; J. H. Lewis to Air Ministry as Deputy Director of Aviation Medicine; J. F. Sandow, O.B.E., to Headquarters, 2nd T.A.F., as Deputy Principal Medical Officer; J. D. Tonkinson to R.A.F. Warton as Commandant, Medical Training Establishment; A. M. Weston to Headquarters, F.E.A.F., as Deputy Principal Medical Officer.

Wing Commanders: A. J. Barwood, O.B.E., to the Institute of Aviation Medicine; F. S. Krusin to the R.A.F. Hospital, Uxbridge, to command; R. Maycock, A.F.C., to M.o.S.; R. W. Oxspring, D.F.C., A.F.C., to Air Ministry for duty in the Department of the C.A.S.; M. N. Phillips to the R.A.F. Hospital, Wegberg, 2nd. T.A.F., as Specialist in Radiology; D. I. Pike, M.C., to Headquarters, Allied Air Forces Northern Europe, as Executive to the Chief of Staff; T. H. Redfern to the Central Work Study Unit; G. C. R. Ackrill, M.B.E., to SHAPE, for staff duties; D. B. Ainsworth to No. 23 M.U. to command; W. G. Alexander to Headquarters, No. 1 Group, as Senior Medical Officer; R. L. W. Baelz, D.F.C., to Air Ministry for duty in the Department of the C.A.S.; K. E. W. Brace to Headquarters, F.E.A.F., for administrative staff duties; R. G. C. Castell to Headquarters, F.E.A.F., for technical staff duties; D. I. C. Eyres to the Ground Officers Selection Centre, as President of the Board; A. J. Handley to R.A.F. Aldergrove for technical duties; H. W. Harrison to the R.A.F. Staff College, Andover, for directing staff duties; J. W. Lovell to Air Ministry for duty in the Department of the Air Member for Supply and Organization; B. P. Mugford to R.A.F. Honington for flying duties; D. G. Roberts, M.B.E., M.M., to the Joint School of Chemical and Nuclear Ground Defence; R. C. E. Scott, M.V.O., A.F.C., to Headquarters, R.A.F. Transport Command, for staff duties; H. W. Secar to Headquarters, Technical Training Command for administrative staff duties; E. B. Symonds to No. 60 M.U. to command; J. E. P. Thompson, A.F.C., to R.A.F. Cambridge to command.

GLIDING AND SOARING.—Members of the R.A.F. Gliding and Soaring Association last month gave a luncheon in honour of Air Cdre. G. J. C. Paul, founder-chairman of the Association, who has recently retired from the Service and is now Secretary-general of the Air League. Above, Air Marshal Sir Raymund Hart (left), their president, hands a silver model of a glider to Air Cdre. Paul. Right, Air Cdre. Paul with the members who attended the luncheon.

The Key to Survival

By Air Marshal Sir Robert Saundby

FOR three years running, from 1954 to 1956, in the month of October, Field Marshal Lord Montgomery recorded his views on current c ence problems in a lecture to the Royal United Service Insti tion. In 1957 he missed a year, but on October 24 last he gave a lecture entitled "The Present State of the Game in the Contest between East and West, and the Future Outlook." This title, which has aroused some criticism, might suggest a light-hearted approach to what is, without doubt, the most serious problem in the World today. And some of the headlines in the daily papers may have given the impression that the lecturer was chiefly concerned to attack the record of the post-War Labour Government, and to blame the United States for tardiness and mistaken policies.

Nothing could be more misleading; the lecture was, in fact, an acutely reasoned appreciation of the situation, based on Lord Montgomery's great experience of high command, and in particular on his seven years' service as Deputy Supreme Commander, NATO. As, however, this was his first lecture since leaving the active list, it might have been expected that he would allow himself rather more than his customary directness and freedom of speech.

After the War

He began with a brief survey of events following the end of the Second World War. The U.S.S.R., forced against its will during the War into the Western Alliance, began a cold war against the free world as soon as Germany had been defeated. The threat from the East, culminating in the Russian blockade of West Berlin, which was countered by the tremendous feat of the air lift, created great tension in the Western world. In September, 1948, it was decided to set up a Western Union Defence Organization. This was soon widened to include the U.S.A. and, in April, 1949, the Treaty was signed which brought NATO, now composed of 15 nations, into being. The military strength of NATO gradually increased, and the advent of the nuclear weapons influenced our strategy in two ways.

First, the nuclear weapon acquired such tremendous power that it was clear that no profit from full-scale war could come to any nation. The object of our strategy now became to prevent war, rather than to wage and win it.

Secondly, it had become clear that if the NATO Powers relied on conventional forces, they could never hope to match the conventional strength of the U.S.S.R. They had, therefore, no alternative but to state publicly that if subjected to a major attack they would use nuclear weapons to help in their defence, even if such weapons were not used against them in the first instance. This is the position today.

Lord Montgomery then considered the 1958 balance sheet in the cold war. He pointed out that it was high time that NATO realized that the struggle against international Communism was a global struggle, and not one which could be confined to the NATO area. He then displayed two maps; the first one showed the "line-up" of countries when the War ended in 1945, while the second gave the situation as it is today. He pointed out that China had become Communist and that Tibet had disappeared behind the Iron Curtain. Indonesia, Indo-China, Burma, Ceylon, and India, comprising a vast area of great strategic and economic importance, were all lost for cold-war purposes to the Western cause.

The United Arab Republic of Egypt, Syria, and the Yemen was more closely aligned to the U.S.S.R. than to the West. The position of Iraq was doubtful. As a result of Russian intrigue in this area, in which she had no legitimate interests, the Middle East was split into hostile groupings, and the positions of Jordan and Lebanon were precarious. Saudi Arabia was trying to keep a foot in each of the conflicting Arab camps. One thing alone united the Arab world—hostility to Israel—and the preservation of Israeli integrity was now more important than ever. Aden, an air and naval base of the first importance, was threatened with trouble from the Yemen.

Looking westwards, the Sudan and Libya were now outside our camp. Tunisia and Morocco were doubtful, and the French had a terrific problem in Algeria. He emphasized that the map showed how the Communist world, led by Russia, had been making trouble for the West outside the NATO area for years.

Lord Montgomery then turned to Europe. Eastern Europe, dubious in the first map, was now all behind the Iron Curtain. Germany was divided and "the Communist tide had advanced to within a day's car drive from Paris." On the other hand, there had been gains. NATO had been formed and Norway, Denmark, Portugal, Greece and Turkey were within the Western Alliance. Later, during the discussion, Lord Montgomery said that—although it was a political question—he thought it would be good if "Spain came into the party."

Yugoslavia, behind the Iron Curtain in 1945, was now free of control by the Kremlin, and is a neutral country.

Thus, in the balance sheet, only Europe showed a profit, and the reason for this was the existence of NATO. But, in his view, the NATO nations, while watching all the "trees," had failed to see the global "wood," and because of that we were badly placed in dealing with what is essentially a global problem. But we could take comfort from the fact that Europe is now the area where the danger is least.

Lord Montgomery showed, in the most convincing way, that wherever it is possible to stand up to international Communism the danger recedes. But there is a risk of the NATO front in Europe becoming a sort of Maginot Line, whose relatively unprotected flanks could be turned.

He then considered where the blame lay for the failure to prevent the advance of Communism during the post-War years. He said that our preoccupation with the building of a welfare state in Britain absorbed most of our energies, and that a distracted World, looking for British leadership, did not get it. Secondly, the foreign policy of the United States had been inconsistent. She supported the ex-colonial Powers in Western Europe but worked to destroy their influence in Asia and Africa. As a result, "we witnessed the decline of the Dutch, French, and British Empires, which should have been stabilizing influences in the rough and tumble of post-War years."

He maintained that the United States has always been at least two years behind in her understanding of Europe and its interests. It was two years before she joined the First World War; two years before she joined the Second World War; two years before she realized the implications of the Suez operation; and more than two years before she joined the Baghdad Pact.

He said that it must now be clear to all, except the very stupid, that if America had not sabotaged the Suez operation, and had joined the Baghdad Pact earlier, the situation in the Middle East would be very different today. The United States in the past had failed to understand that Europe depended for much of its prosperity on areas outside Europe, and had yet to learn that Africa is essential to Europe and the Western Alliance.

Russia's Tactics

Lord Montgomery then considered future Russian policy. In his view, the Russians had no intention of resorting to full-scale war so long as we retained our power of nuclear retaliation. They had "other plans, more subtle and less dangerous for themselves, but terribly dangerous for us." For the past 10 years we had been fighting a battle to prevent a war; that battle had now been won and a major war was most unlikely, provided that we kept the deterrent. The battle of the next 10 years would be very different; it would be political, financial, and economic. Russia would now attempt to bring about the collapse of the economic system of the free world, and would encourage the countries of Asia and the Middle East to rise up and sabotage our interests.

In Western Europe, including the United Kingdom, there was a shortage of all raw materials except, possibly, coal. Large quantities of oil, food, and other primary products had to be imported and we must be able to protect the sources from which they came, and the transit areas through which they passed. Failure to do so would lead to the collapse of our economy, and ultimately to the loss of Western Europe to international Communism without a shot being fired.

(*Continued on page* 823)

(*Continued from page* 822)

In his opinion, the Western Alliance was not organized to deal successfully with the political, financial, and economic battle of the next few years. We must have unity in our political and economic policies, and ensure that our joint resources were used to the best advantage. Lord Montgomery added that there was, at present, no unity of policy among the Western nations.

The outlook of NATO was not global. One group of nations was mainly concerned with parochial affairs; the other group had world-wide interests, and it had so far proved impossible to hammer out a common policy between the groups. Indeed, the Powers with world-wide interests had not even been able to agree on a common policy among themselves. To continue in this way was "just crazy," and would invite disaster.

After a passing reference to the lack of initiative in the West—perhaps inherent in democratic countries—Lord Montgomery turned to the future. The next battleground in the cold war lay in Asia and Africa. Propaganda would be an essential weapon in this battle. We should make every effort to regain the political initiative, and we needed a military re-grouping and re-deployment.

Reverting to the problem of NATO defence, Lord Montgomery displayed a map of NATO Europe, as seen from a viewpoint high in the air over Moscow. He pointed out that NATO Europe is one large peninsula, with its flanks and rear on the sea. These must be absolutely secure, and so must our air flank. On land, six areas were enormously important: Scandinavia; the United Kingdom; Spain and Portugal; French North Africa; Italy; and Turkey, particularly Anatolia. These areas were essential to the security of our sea flank, and if that went we should be in grave danger of defeat.

A Mobile Battle

NATO forces were insufficient to hold the whole area with a rigid defence; therefore we must hold the lynch pins, the vital areas, and elsewhere fight a mobile battle. Control of the Atlantic communications, linking NATO Europe with the American continent, was also vital. Our strategy must "be based on confining Russia to a land strategy, by retaining control of the seas in our hands and by preventing Russia from interfering with our use of the air flank."

Looking more closely at the air flank, Lord Montgomery said that "for the next five years, and more likely 10, the main agent for delivering accurate nuclear fire power against an enemy country will be manned aircraft." Although after that time the number of manned bombers might decrease, he did not agree with those who said that the manned bomber would become obsolete. He believed that there would always be a need for manned strategic air forces, "to give flexibility to the overall plans and in order to locate interior targets in the enemy country." It should be assumed, for the foreseeable future, that "at least 25% of our total fire-power delivery capacity will be the manned bomber, the piloted aircraft." In air defence, he suggested that the best ratio would be found to be approximately three-quarter missiles to one-quarter manned aircraft.

These estimates are extremely interesting, and I believe that they are very close to the figures now advocated by many people in a good position to judge.

Lord Montgomery did not think that the risk of surprise attack was very great, because any such attack must be followed by unlimited warfare with intensive operations on land, at sea, and in the air. Therefore an aggressor nation would have to take measures to get ready for unlimited war, and these measures could not be hidden.

This led him to the problem of mobilization, and he had very little to say in favour of our present arrangements. He thought that perhaps we needed a new word for mobilization in a nuclear age. At any rate we needed a system that would be effective in a matter of hours. He believed that the whole question "required a new look."

On the need for conventional forces, Lord Montgomery said that when both sides had nuclear sufficiency "the deterrent will merely serve to deter each side from using it as a weapon." But in the event of a "major act of aggression which directly threatened to overrun the home country of any NATO nation, the full weight of the Western deterrent would be brought into action at once against the home country of the aggressor nation." Russia understood this very well, and she would not commit national suicide by risking an all-out nuclear war.

The deterrent must be a Western one, mainly provided by the United States, but this country should contribute to it and must produce tactical nuclear weapons. After the deterrent, the first priority for the NATO nations is to be able to deal effectively with cold-war activities, and play their full part in limited wars. This meant "the provision and upkeep of efficient conventional forces—Navy, Army, and Air Force—armed with proper equipment, which must include tactical nuclear weapons. In the air it will be important to maintain an adequate bomber capability, which in Europe should be supplied mainly by the United Kingdom."

He ended this survey with a warning that if any NATO nation put too much effort into the nuclear deterrent, at the expense of conventional forces, it would be playing into the hands of Russia. "Defence will become so costly that that nation will not be able to make, in addition, a first-rate contribution to NATO of conventional forces armed with first-rate equipment."

Finally, Lord Montgomery said that the NATO organization was at present complicated, cumbersome, and over-staffed. There were too many committees, and it took far too long to get anything done. He thought that the Standing Group in Washington should be moved to Paris, and SHAPE left free to carry out its proper duties as a military headquarters.

But, above all, we needed true unity, built on the solid rock of Anglo-American friendship. We needed unity of purpose and unity of policies, and if we failed to achieve this the Communists might well win.

It is interesting to note that on four major points Lord Montgomery's views are very close to those of General Gavin of the U.S. Army, who recently resigned from the post of Assistant Chief of Staff in Washington owing to his serious disagreements with the official policy of the Department of Defence.

Both insist on the paramount importance of achieving unity of purpose in the West, and the danger of allowing the present unsatisfactory situation to persist. Both agree that, in the nuclear age, the whole World is one tactical theatre, and that it is folly to think in terms of European defence, while disregarding events in Asia, the Middle East, and Africa. Both emphasize the need for powerful and mobile conventional forces, armed with tactical nuclear weapons. And, lastly, they agree that any over-expansion of the Western deterrent would be to play into Russian hands.

This is the most comprehensive and balanced survey that Lord Montgomery has yet given us, and we should do well to give it the attention it deserves. Especially should the NATO nations, before it is too late, heed his plea for unity of purpose, and the hammering out of a common policy. This is the crucial problem and once it is solved, and the global nature of the struggle against international Communism recognized, the solution of all the remaining problems will prove to be relatively simple. But without Western unity the future of the free World is bleak indeed.

NATO DEFENCE.—The Fiat G.91 "first generation" fighter selected for the Italian, German and Turkish air forces after international competition. It has a Bristol Orpheus turbojet.

Photograph copyright "The Aeroplane"

FLYING THE TC

RAMJETS offer a number of advantages as helicopter powerplants in eliminating complicated transmissions, clutches, gearboxes, engine-cooling fans and so on, but the H-3 Kolibrie produced by the Nederlandse Helicopter Industrie N.V. is one of the few practicable rotorcraft designs to utilize with success this type of propulsion. The use of ramjets, which have a very heavy fuel consumption, involves, however, its own limitations, and these shape the aptitude of the Kolibrie towards certain short-range missions where its high ratio of payload as a percentage of gross weight can best be used.

Agricultural operations are among the most obvious applications for the Kolibrie, which, as we mentioned recently in THE AEROPLANE, has been selected by European Helicopters, of Ipswich, for their next season's spraying. During the past season European Helicopters operated two hired "10-metre" Djinns on crop-spraying in East Anglia and elsewhere in the U.K. with some success, so that the company already has considerable experience with tip-propelled helicopters. On that basis the first Kolibrie was recently purchased by European Helicopters, who are also U.K. agents for its sale, and one or two more are soon to follow.

At present registered PH-ACD, the first U.K.-based Kolibrie (the 10th of 11 so far produced) is awaiting an "aerial-work" validation of its Dutch Type C. of A., which was awarded on March 3 this year and was the first in the World granted to a ramjet aircraft. Despite the characteristic, anti-cyclonic fog of this time of the year I was able to make a brief handling flight in PH-ACD last week with Claude Millant, chief pilot of European Helicopters, at Ipswich, and gain some idea of its flight and powerplant attributes.

On approaching the Kolibrie, perched on its Helicar trailer which is produced by N.H.I. for cross-country transport, its very small size is immediately apparent, and closer examination reveals its remarkable simplicity. On the steel-tube frame of the undercarriage skids are hung four cylindrical tanks, each of 22-Imp. gal. capacity. Normally, the inner two are used for fuel and the outer pair for agricultural chemical, but if required the latter may be quickly replaced by similar tanks for the domestic kerosene used by the Kolibrie's TJ-5 ramjets.

The availability and low cost (about 1s. 3d.-1s. 6d. per gal.) of this fuel do much to offset the maximum endurance of about half an hour conferred by the 44 gal. of the normal two tanks, particularly as in agricultural operations, sortie times are usually limited to a few minutes. Refuelling can then be accomplished simultaneously with reloading chemicals every third or fourth trip, the only remaining problem being the provision of a suitably large tanker to provide fuel for a full day's operations.

All fuel and chemical pipes in the Kolibrie are of transparent plastic, and it is something of a novelty, as well as being very useful, to be able to see one's fuel flow. One of the pipes extends up alongside the simple central instrument console to form a visual fuel gauge, and another important indicator at the top of the panel is a dual-reading flowmeter for both ramjets.

Although this is calibrated metrically, it is marked, like most of the other instruments, with coloured segments indicating normal, acceptable, and limiting ranges of operation, and enables an immediate, if approximate, indication of power output to be obtained. This is otherwise not possible with ramjets, as one discovers when finding, with a slight shock, that the rotor r.p.m. gauge has only one needle, which is not, as is usual and for obvious reasons, superimposed on an engine tachometer.

The remaining cockpit equipment is conventional enough, with an altimeter, V.S.I., low-reading A.S.I., clock and ammeter, and fuel and ignition controls at the bottom of the console. Full dual controls, including collective-pitch levers, are removable when not required, cyclic pitch being changed by a robust Y-shaped hanging control column directly linked to the rotor swash plate. This system, which I first encountered in the old Hiller 360, is light and simple, although perhaps less comfortable than conventional floor-mounted sticks.

In the interests of weight saving the "cabin" of the Kolibrie is floorless, backless and sideless, but the big front screen, with its overhead extension, gives adequate protection from the slipstream. Taking care not to step on the thin metal fuel tanks, one settles gingerly into one of the two seats mounted on a cross-tube of the undercarriage, and finds that the controls come conveniently to hand despite the acute angle of the collective-pitch lever at its lowest position.

To spin the see-saw-type rotor to ramjet light-up speed, a small 2-b.h.p. two-stroke one-cylinder engine is mounted behind the central tubular pylon with a chain drive to the tail rotor shaft. The latter is interconnected with the main rotor shaft and drives the little single-bladed tail rotor, which is almost entirely for directional control. The starting engine, which is hand-started on the outboard principle, is controlled through a motorcycle-type twist-grip throttle and hand clutch lever mounted between the two seats, and has two-speed gearing. If its 30-lb. weight is unacceptable for some operators, a flexible drive can be provided from an external source.

In first gear the clutch is engaged to turn the rotor to about 60-80 r.p.m., when the ignition can be switched on and the main fuel cocks opened. The electric fuel pump is needed only to charge the system, after which centrifugal force maintains an adequate fuel flow at all rotor speeds. This is hardly surprising since, at the rated rotor speed of about 400 r.p.m., the 20-lb. ramjet units are subjected to something like 820 *g*. Their output is then about 49.5-lb. thrust, or some 50 h.p. each.

Light-up is accompanied by impressive tongues of flame, but as the initial thrust is insufficient to exceed the ramjet drag, the starter engine must be accelerated and changed into second gear to increase the rotor speed to about 150 r.p.m. It may then be disengaged and switched off, and the pitch-lever throttle twisted slowly open (to avoid flame pulsation) for a power check at 400 rotor r.p.m.

Photographs copyright "The Aeroplane"

Above, left, a cargo hook underneath the Kolibrie has a maximum capacity of 820 lb. for short "flying crane" trips. This view also shows the additional two-stroke motor for pumping spray chemical. The "bent" rotor effect results from the use of a focal-plane camera.

On the right can be seen the flexible spray booms fitted to the Kolibrie, while at the top of the facing page the simple cockpit layout is shown.

TCH KOLIBRIE

By John Fricker

Fuel flow should then be adjusted by the two cocks to read 550 lb./hr. per engine, and the throttle opened and closed once or twice while watching the fuel lines to make sure no air bubbles are present. As ignition is continuous, power to the spark plug is not required after the ramjets become "self-supporting," but slight care in throttle handling at the minimum idling speed of 200 rotor r.p.m. is needed to avoid a flame-out.

At this stage the flames from the ramjets are much less evident, and are probably almost invisible in sunlight, but the noise changes to an impressive and penetrating roar, which makes a "bone-dome" thoroughly desirable. There is a welcome lack of high-frequency vibration, however, and only the usual slight oscillation in the cyclic stick inevitable with a two-bladed rotor is apparent.

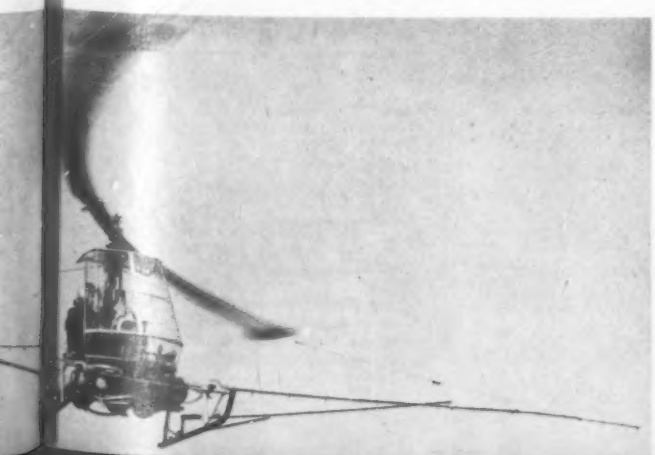
After the brief ground checks the Kolibrie is ready to go, and with the cyclic-control column held firmly central the pitch lever can be inched up for take-off. The latter movement is linked as usual with the throttle, and only minor compensatory movements of the twist-grip are needed to maintain about 400 r.p.m. One notices immediately the welcome lack of torque reaction from power changes, so that little or no rudder is required to keep straight, but some time was needed to judge the speed of power response.

As one would expect from the length of the fuel leads, there seemed to be a slight lag in rotor-speed change to throttle movement, which, coupled with a fair degree of sensitivity, made the precise maintenance of the desired r.p.m. difficult. This was probably complicated by my general inexperience on helicopters, but in fact the Kolibrie has a wide range of usable rotor speeds between the minimum for safe handling of 370 r.p.m. and the overspeed maximum of 440 r.p.m.

The helicopter is controllable at much lower r.p.m., but the decrease in rotor tip-speed is accompanied by greatly reduced ramjet thrust. Overpitching, with a large amount of collective pitch and a high fuel consumption, resulting in power settling, is then much more likely. Because of the drag of the ramjets, the rotor r.p.m. can fall quite quickly with excessive reductions of power but, on the other hand, it is possible to build up a very useful margin of power by overspeeding within the limits, thus permitting a vertical "jump" take-off, which is extremely useful with an overload or at high aerodrome altitude.

Performance of the Kolibrie, like other "jet" helicopters, is fairly sensitive to temperature and loaded weight, but the vertical climb may be as high as 1,600 ft./min. A more representative climb, however, at a forward speed of 30 m.p.h. and a mean weight of 1,100 lb. is about 800 ft./min.

It is inevitable, in so brief an acquaintance with a rotorcraft as novel as the Kolibrie, that most of the impressions recorded here are concerned more with the powerplants than with general helicopter handling, but groping round in the fog at Ipswich airport, which became more or less invisible from 300 ft., gave a reasonable idea of the docility and response of the controls. The N.H.I. designers have managed to achieve about neutral dynamic stability with the Kolibrie, which is an improvement over the instability of most other helicopters, and the control loads have been kept reasonably low without recourse to power boosting.



I found myself slightly ham-footed on the rudder pedals, which are fairly sensitive in flight although requiring fairly large displacements when hovering, and I also overcontrolled on the cyclic stick during hovering, but this again is a product of helicopter inexperience. In general, the lack of interconnection between power output and directional control requires much less co-ordination and results in a much easier helicopter to fly, with the additional and substantial advantage of excellent manœuvrability under all conditions. This is particularly useful when crop-spraying. When hovering the Kolibrie can be spun round at up to 90°/sec., using the powerful directional control and assisted by the low inertia of the short "fuselage."

Trim changes with speed seemed to me slight, and controls for both longitudinal and lateral bias are provided just above the pilots under the rotor-head. As a short-range vehicle the Kolibrie is expected to make most of its journeys on the Helicar, so that its low "never-exceed" speed of 70 m.p.h. is therefore of less importance than it might sound. This, after all, is quite respectable for what is intended to be virtually an airborne tractor, and the Kolibrie can be cruised for range at 62 m.p.h.

A valuable feature for agricultural operations is that, unlike nearly all other rotorcraft, the Kolibrie can achieve safe auto-rotation from any speed or altitude, the optimum rotor speeds being between 350-400 r.p.m. Autorotational safety is obtained independently of the twin-engined aspect, since the Kolibrie cannot maintain height on one ramjet. Power failure in such simple units is very remote, but in such an eventuality, 350 rotor r.p.m. can be maintained during a reasonable rate of descent at 30 m.p.h. forward speed by opening the throttle to increase power of the remaining ramjet and slightly lowering the collective-pitch lever.

Asymmetric thrust results in a substantial one-per-rev. vibration, but no effect on control for a flare-out to zero forward speed at about 50 ft. As the rotor r.p.m. decrease below 280 r.p.m., tail-rotor effectiveness may decline, but the Kolibrie can be landed without its aid if necessary, with a maximum rate of turn through rotor bearing friction of 36°/sec. Run-on landings are possible up to forward speeds of 20 m.p.h.

To maintain adequate r.p.m. against ramjet drag for a completely power-off autorotation, the main rotor of the Kolibrie is set at a minimum angle which results in a rate of descent of something like 3,500 ft./min., despite the low disc loading of about 2 lb./sq. ft. The rotor-speed margin is such, however, that plenty of time is available to reach autorotational r.p.m. at 30 m.p.h., or to land safely from low altitude.

M. Millant showed me an exhilarating autorotation from 300 ft., with a leisurely vertical landing, and it is possible for an experienced pilot to take off again from such a touch-down for a brief hop with the rotor power in hand. When practising, however, sharply closing the throttle to idling may cause a flame-out, which can only be re-lit by reducing rotor r.p.m. on the ground to the starting sequence.

With its low initial cost of about £8,000, and the possibility of low operating expenses from reliability and the simplicity of its conception, the Kolibrie offers an interesting new approach to rotorcraft performance. It has many applications in addition to agricultural flying, and as a flying crane, for example, has a cargo hook under the fuselage with a capacity of 820 lb. It has been fitted with floats and external stretchers, and has lifted up to four people.

Credit is also due to the designers for developing the small ramjets to the point of commercial operation. At the moment these units are returned to the Kromhout factory for check and overhaul after 150 hr. running, but this figure is eventually to be increased to 300 hr. As the engines are secured to the blades by only two bolts, and have automatic fuel and ignition pick-ups, replacement is rapid, and at about £750 the cost of two spare ramjets is not excessive.

Leading Particulars

DIMENSIONS.—Main rotor diameter, 33 ft.; length, 13 ft. 10½ in.; skid track, 6 ft. 3 in.; height, 8 ft. 5 in.; tail-rotor diameter, 2 ft. 9 in.

WEIGHTS.—Empty, 530 lb.; pilot, fuel and equipment (civil), 904 lb., (military), 1,014 lb.; max. gross (civil), 1,434 lb., (military), 1,544 lb.

PERFORMANCE.—Max. cont. speed, 62 m.p.h.; agricultural operating speed, 15-50 m.p.h.; limiting wind speed, 35-45 m.p.h.; max. endurance, 1 hr.; hovering ceiling in ground effect, max. gross, 4,000 ft.; at 1,200 lb., 10,000 ft.; max. climb at max. gross and T.O. power, 525 ft./min.; at 1,150 lb., 1,200 ft./min.

More about Naval Firestreaks

LAST WEEK, the operational trials of the D.H. Firestreak air-to-air missile from H.M.S. "Victorious" were revealed for the first time in THE AEROPLANE, and it is now possible to add further background material on the naval application of this important weapon.

The early history of the Fleet Air Arm's first-hand associations with AAMs dates back to 1953, when a naval technical team was engaged on the Fairey Fireflash project. In January, 1955, attention was turned to the Firestreak when an air electrical officer and a gunnery officer were assigned to the D.H. Propeller Co., at Hatfield, as part of the Services research and development liaison team. Specially equipped aircraft used for the initial development of the missile from Hatfield included a Swift F.1, a Meteor 11, a Canberra B.2, a Firefly 7, and Venom all-weather fighters.

In mid-1956 the Joint Services Trials Unit, as it became known, was transferred to the Weapons Research Establishment, Salisbury, South Australia, to prepare for Ministry of Supply and combined R.N./R.A.F. acceptance trials at Woomera. The procedure and technical support of these trials was undertaken entirely by Service personnel with the object of proving the Firestreak for production.

Development firing was performed by R.N. and R.A.F. pilots from specially adapted Canberras and Commonwealth Avon-Sabres against pilotless Jindivik high-speed targets. The effectiveness of the Firestreak was rapidly illustrated by the number of targets which were completely destroyed although the missiles were not fitted with warheads. The technical nucleus of the naval party engaged in this work subsequently joined H.M.S. "Victorious" to provide continuity of the overall programme.

As related last week, "Victorious" is the first F.A.A. carrier to have special accommodation for the Firestreak, which is undergoing final acceptance trials in the Mediterranean. The assembly and stowage of this weapon involves the use of a comprehensive range of automatic and semi-automatic test equipment built up in console form together with the provision of ready-use magazines, for fully assembled pre-checked missiles.

Considerable space was necessary to house this equipment, and a series of additional compartments was constructed within the hangar amidships on the port side. By their use prepared missiles may be readily transported to the flight deck for aircraft arming.

The first naval aircraft to carry the Firestreak as standard will be the Sea Vixen, but this will not be operated from

One of the first test vehicles for Firestreak was this D.H. Venom N. F. 2 which had a similar equipment installation to the Sea Venom FAW. 21s of No. 893 squadron.

H.M.S. "Victorious" on a squadron basis during her present commission. In the meantime, to gain sea experience in the maintenance of the missile and to provide pilot familiarization in its application by carrier-borne aircraft, No. 893 Squadron has received three Sea Venom FAW.21s modified to carry two Firestreaks, with the appropriate fire control, camera and instrumentation installation.

This equipment enables the results of each sortie to be analysed at leisure. Since the Squadron embarked on September 25 the Firestreak-carrying Sea Venoms have been integrated into the normal flying programme and a number of successful sorties have been achieved. The aircraft have the dual function of releasing live missiles and also of carrying an "acquisition round," which gives simulation of the interception phase of an attack without the ability to fire.

Two Sea Venoms equipped in this fashion can reproduce all aspects of guided-weapons warfare by airborne exercises, each aircraft acting in turn as target. A similar facility is being made available in the Sea Vixen for pilot and observer training.

The trials of the Firestreak as a carrier-borne weapon are a continuation under specialized conditions of those conducted by the Joint Services Trials Unit at Woomera. The special Sea Venoms completed deck-landing trials with dummy missiles at R.A.E. Bedford earlier in the year, and then on "Victorious" during the first practice flying in June. Apart from slight differences in aircraft handling and fuel consumption, there was no appreciable variation from the standard Sea Venom. An investigation was also made into the hazards of the Firestreak in a carrier environment to ensure that equipment such as radar would not affect the complex control circuits of the homing apparatus.

Firestreak is built up from six main sections: guidance, control and fusing systems, power supply, solid propulsion motor and warhead. They are housed in an aerodynamic body tube 10 ft. 6 in. in length, fitted with four small wings and control fins.

Responsibility for the flying aspects of the current trials is in the hands of Lieut. Cdr. E. V. H. Manuel, who is C.O. of No. 893 Squadron, while preparation of the missiles and technical supervision is undertaken by the ship's air electrical officer, Lieut. Cdr. M. K. Faulkner. Deputy A.E.O. and trials officer from the Joint Services Trials Unit at Salisbury, S. Australia, is Lieut. Cdr. K. C. A. Monnery, while the ship's gunnery officer, Lieut. Cdr. P. J. M. Shevlin, is responsible for the weapons aspects of the undertaking.

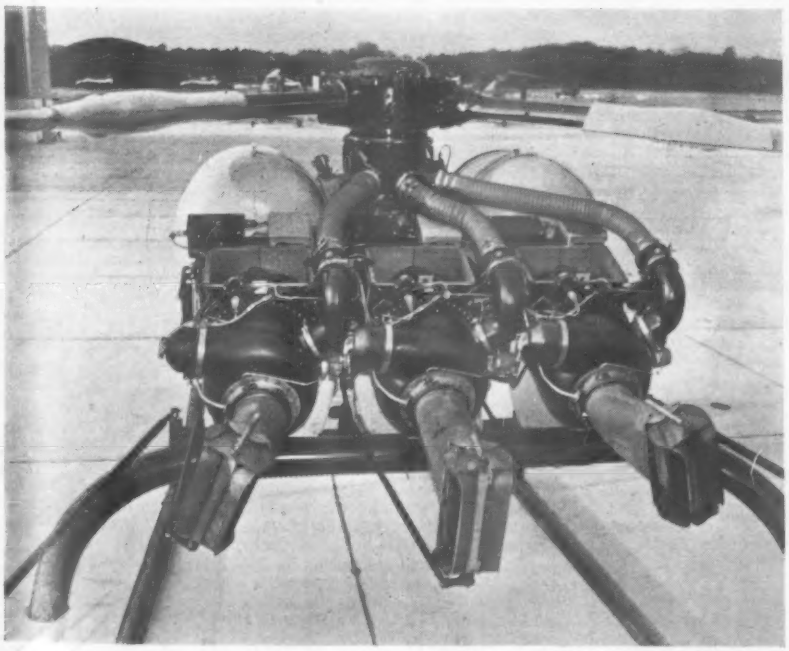
Now entering service with the Royal Navy at Yeovilton, the D.H. Sea Vixen has four Firestreaks as its primary armament for airborne interceptions.

New World Photo-News

Recently demonstrated in public for the first time, the McDonnell 120 utility helicopter "crane" is powered by three AiResearch gas turbine compressors supplying tip-jet units.

Pictures by Howard Levy

Left, tip-jet size is evident from this photograph. Bleed air in the Model 120 is at 300 degrees above ambient temperature and provides automatic de-icing for the rotor.



Above, the rotor has only 14 bearings and is so designed that no bearing operates under centrifugal load. The blades are supported by bundles of stainless steel straps, providing high in-plane stiffness to the blades which eliminates the need for dampers.

Below, the neat overall layout of the McDonnell 120 is well in evidence in this view. Each of the three powerplants develops 85 h.p. and water injection is used—plain tap water being sprayed directly across the top of the intakes.

Above, the self-contained, fully automatic, uncowled engines are installed at eye-level height which facilitates routine inspection. It is claimed that a single engine may be replaced without the use of any tool in 5 minutes.

A Versatile Russian Biplane

ONE OF the most widely used Russian aircraft in the lighter category is the Antonov An-2 Kolchosnik, which is unusual in being a biplane of comparatively recent design, and is in service with the civil or military air fleets of all the Iron Curtain countries. It is being built by Communist China as well as by the U.S.S.R., in a number of different versions for an extraordinary variety of tasks, including light passenger and freight transport, parachute training, crop-dusting and spraying, glider-towing, forestry patrols, as an air ambulance and for aerial survey. With a ski undercarriage the An-2 has taken part in Arctic and Antarctic exploration, and a floatplane version has also been produced.

Like the D.H. Otter in the West, the An-2, in fact, is an excellent design for bush-flying, with a particularly short take-off and landing performance conferred by its low wing-loading, full-span slotted flaps and ailerons, and automatic slats on the leading edge of the upper mainplanes. It is extremely robust, with an all-metal semi-monocoque fuselage and fabric-covered metal wings and tailplane, but its wire-braced biplane layout naturally incurs some drag penalty, although having a relatively low structure weight.

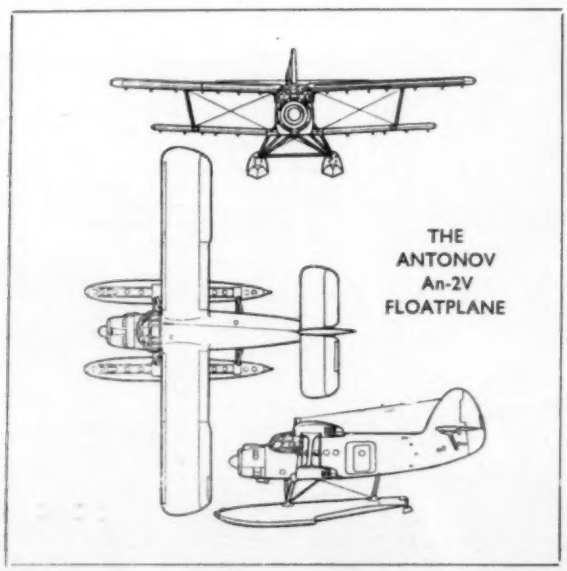
In its original form, the prototype An-2, which first flew as long ago as 1947 as the SKh-1, was powered by a 630-b.h.p. ASh-21 radial engine, but production aircraft were subsequently fitted with the nine-cylinder 1,000-b.h.p. ASh-62 IR, driving a four-bladed constant-speed V-509A-D7 aircrew of "scimitar" pattern. Even with the larger engine, the An-2 has a very poor climb (of about 350 ft./min.) with a maximum load, although the unstick distance remains short at all times.

For research purposes an experimental version of the An-2 was fitted with a turbo-supercharged ASh-62IR/TK engine, which maintained 850 b.h.p. up to a height of 30,000 ft., compared with the normal rated altitude of 5,000 ft. This special An-2/ZA, which had another cockpit installed forward of the fin for meteorological observation, established an altitude class record of nearly 37,000 ft. in 1954, and was also fitted for glider-towing.

The capacious cabin of the standard An-2, which is 13.4 ft. long, 5.9 ft. high and 5.2 ft. wide, with a total volume of 423.7 cu. ft., was soon put to good use in Aeroflot service, as well as with DOSAAF, the para-military Soviet sporting flying organization. Aeroflot received several variants for passenger, freight and agricultural duties, and these comprised the following:

The An-2P (Passajirskii), which is comfortably furnished and has reclining seats for seven-eight passengers, plus 200 kg. of freight. A rear toilet compartment is also provided, together with full cabin heating, soundproofing and ventilation.

The An-2S (Selskokhoziaistvennii=rural economy), which is equipped primarily for agricultural duties, but may also be used for forest fire-fighting and freighting. With a slightly lengthened undercarriage the An-2S may be used for either dusting or spraying, and offers a maximum agricultural payload in the region of 3,000 lb. Normal chemical load is quoted as 2,200 lb., within a gross weight of 10,448 lb., which includes 1,014 lb. of fuel.



THE ANTONOV An-2V FLOATPLANE

In the cabin of the An-2S is a 307-gal. tank or hopper, which may contain liquids or solids and be used in conjunction with underwing spray bars or a ventral venturi spreader. In the latter case, a windmill above the fuselage drives pulverizing gear in the hopper, while a larger windmill below the fuselage supplies pressure for the spray pump. Loading is by means of two filler pipes with access from the top of the fuselage. With a swath width of 164-196 ft., the An-2S can distribute powdered chemical at up to 44 lb./sec. and liquid up to 4.3 gal./sec.

Hopper or spray actuation is pneumatically controlled by the pilot, and the best operating speed of the An-2 is 96-102 m.p.h. Take-off distance of the An-2S at its gross weight of 10,448 lb. is quoted as 262-328 ft., with 30° of flap, and landing distance the same, with 40° of flap.

Removal of the agricultural equipment gives the An-2S a freight capacity of 2,733 lb., and the freight hatch in which the passenger door is inset hinges upwards for the loading of articles up to 4.9 ft. by 4.7 ft. Usable cabin space is largely confined to the area forward of the access door, a main bulkhead separating the rear fuselage space aft of the entrance. C.G. range of the An-2 is between 17%-32% M.A.C., at which longitudinal and directional stability are greatest. From personal experience, the An-2 has been observed as frequently flying with a considerable overload at aft C.G. positions, with a noticeable decrease in longitudinal stability. A full account of the flying characteristics was published in THE AEROPLANE of September 7, 1956.

Stripped of soundproofing the An-2 is widely used for carrying personnel on "Dakota-type" folding bench seats along each side of the fuselage, on which 10-14 passengers may be accommodated. In this form it is in service with DOSAAF and the equivalent organizations in other East European countries for parachute training, and is also used for communications. On the walls of the cabin are attachment brackets of the American pattern for loading up to six stretchers, and provision is also made for seating medical attendants and carrying necessary instruments or equipment.

Cockpit equipment in the An-2 is comprehensive for the normal crew of pilot, co-pilot/radio operator and flight engineer/mechanic. Radio aids include a radar altimeter, and a distant-reading earth-induction compass is also carried. The An-2 makes use of pneumatic power for braking, with electric actuation for flaps, drooping ailerons, oil cooler and cowling gills, and trim bias. Engine starting is by an electrically energized inertia system, and a dog for manual cranking is also provided at the rear of the cockpit.

Little has been seen of the floatplane version of the An-2, which can be converted from the normal wheel undercarriage in about 20 hr., and changed back again in about 8 hr. The An-2V has metal floats, each divided into 12 watertight sections, and with pneumatically operated water rudders. Reference is made in its specification to a reversible-pitch airscrew (the V-509-D8, with straight blades) for improved manœuvrability on water, and the An-2V is cleared for operation in waves of up to 19 in. height.

A double-wheel bogie can be attached to each float for launching or beaching the An-2V, which also has a manually operated winch with a lifting capacity of 1,250 lb. for transferring freight from boats or dock into the cabin.

Leading particulars of the An-2V are:—

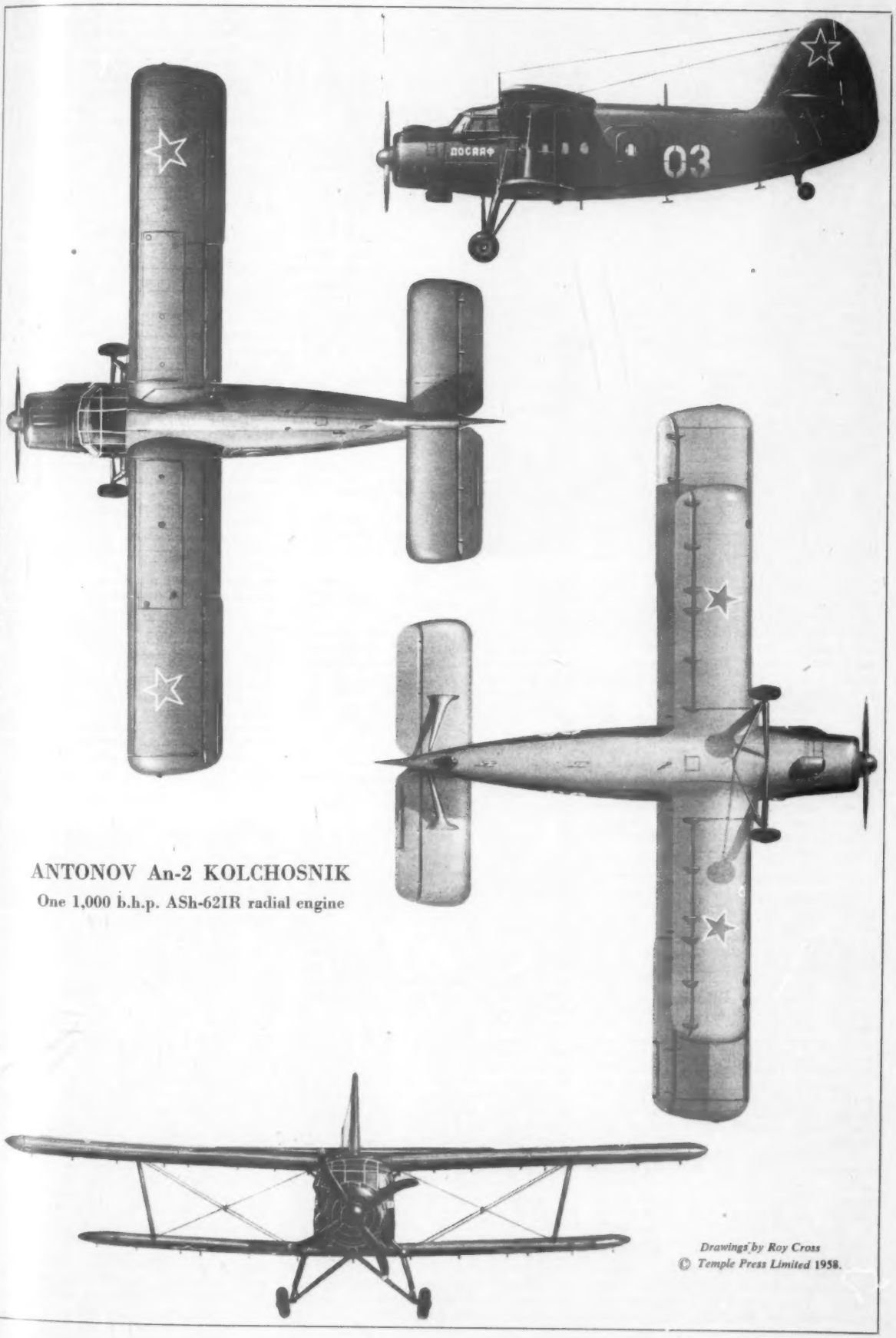
Maximum gross weight, 11,570 lb. (5,250 kg.); payload, 2,028 lb. (920 kg.); max. level speed, 153 m.p.h. (247 k.p.h.); minimum speed, 54 m.p.h. (87 k.p.h.); range at 11,023 lb. (5,000 kg.) gross, with 263 gal. (1,200 litres) fuel and 2,028-lb. (920-kg.) payload, 920 miles (1,480 km.); take-off run, 30° flap, 262-328 ft. (80-100 m.); landing run, 40° flap, 196-262 ft. (60-80 m.); with reverse pitch, 98-131 ft. (30-40 m.); service ceiling, 16,400 ft. (5,000 m.).

Official Russian figures for the An-2 in standard trim are:—

DIMENSIONS.—Span, top wing, 59.62 ft. (18.19 m.), lower wing, 46.71 ft. (14.24 m.); length, 42 ft. (12.8 m.); height, 13.62 ft. (4.16 m.); wing area, 769.61 sq. ft. (71.5 sq. m.); undercarriage track, 11.35 ft. (3.46 m.).

WEIGHTS.—Empty, 7,275 lb. (3,300 kg.); commercial load, 2,733 lb. (1,240 kg.); crew (two), 352 lb. (160 kg.); fuel (138 gal.), 1,102 lb. (500 kg.); oil, 110 lb. (50 kg.); normal gross weight, 11,574 lb. (5,250 kg.).

PERFORMANCE.—Max. level speed, 161 m.p.h. (260 k.p.h.); cruising speed, 124 m.p.h. (200 k.p.h.); minimum flying speed, 56 m.p.h. (90 k.p.h.); with 40° flap and power, 40 m.p.h. (65 k.p.h.); range at max. gross weight with max. commercial load, 559 miles (900 km.); max. range with 1,653-lb. (750-kg.) payload, 1,087 miles (1,750 km.); service ceiling, 16,400 ft. (5,000 m.).



ANTONOV An-2 KOLCHOSNIK

One 1,000 b.h.p. ASh-62IR radial engine

Drawings by Roy Cross

© *Temple Press Limited* 1958.

From the Lecture Room

Inertial Guidance and Navigation

PROGRESS and techniques of inertial navigation and guidance were surveyed by Mr. J. E. Pateman, assistant general manager of Elliott Brothers (London), Ltd., in a lecture before the Guided Flight Section of the Royal Aeronautical Society on November 24. The following account is derived from his talk.

Inertial navigation has been developed largely because of the military requirement for a blind navigational system which could not be jammed by, nor give active assistance to, any potential enemy. It relies on principles which were understood by Newton, but the practical working system has become possible only following intensive development in both the design and manufacturing techniques for gyroscopes and accelerometers.

Basically, inertial navigation depends on measuring the acceleration vector of a body in any convenient axis system and carrying out suitable integration processes to determine its path in space and its position and distance from its initial position.

Acceleration can be measured without reference to the external environment by measuring the force applied to a small body which is constrained to move with the main part of the vehicle. Such a device will also detect forces which do not cause a movement of the main vehicle; examples are accelerations due to gravity and to Coriolis effects. These can be compensated for fairly readily.

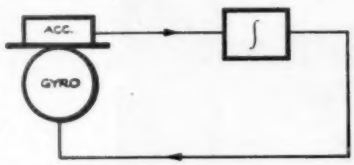
One might expect that the heart of any inertial navigation system was the accelerometer, but this is not quite true. The *prima donna* of the inertial navigation world is, in fact, the gyroscope. This arises from the importance of defining the axis system and from the fact that the Earth, over which the navigation is assumed to take place, is roughly spherical and the direction of gravity is always radial.

Stable Platform

By making use of the properties of gyroscopes, a stable platform can be constructed using either three single-degree-of-freedom or two two-degree-of-freedom gyros. Because such a platform is servo-driven relatively large disturbing torques may be applied to it without displacing it from its fixed orientation in space. This can be done only by applying torques to the gyros themselves, in which case the platform will precess at a rate determined by the applied torque and the angular momentum of the gyro. If no disturbing torques are applied to the gyroscope the platform will clearly remain fixed in space, and we can use it instead of the stars as a reference in a navigational system.

If the vehicle is not subjected to any significant accelerations, the local vertical could be measured by means of a spirit level or similar device, as is done in the sextant. If, as is more usual, the vehicle is being accelerated, an alternative method of finding the true vertical must be devised.

Schuler showed that if a pendulum were constructed with an effective length equal to the radius of the Earth, then any acceleration of the point of suspension would not cause a disturbance to the bob, and the line joining the two would always be parallel to the Earth's gravitational field. Such a pendulum can be represented by the arrangement shown in the diagram. Here, a gyroscopically controlled platform carries an accelerometer whose output is integrated with respect to time, and then used to apply a torque to the gyroscopic element. Assuming for the moment that both platform and Earth are stationary, any tilt of the platform will result in a steadily increasing precession rate and, therefore, a steadily



This Schuler pendulum arrangement for providing a true vertical reference is described in the text.

decreasing angle of tilt of the accelerometer. Such a system, if given suitable constants, will have a period of about 84 min. and will meet the same equations as a simple pendulum with a length equal to the radius of the Earth, conforming with Schuler's requirements.

To keep the platform truly horizontal, torques must be applied to the gyroscope so that it precesses at the angular rotational rate of the Earth, while if the platform is moving rapidly over the Earth's surface, the effect of Coriolis accelerations (which arise whenever there is movement over the surface of a rotating globe) must also be allowed for by injecting the appropriate signal into the integrator in parallel with the accelerometer signal.

Gyro wander will cause the main space-stabilized platform to rotate with respect to inertial axes at the gyro wander rate. A rate of, for example, 1°/hr. is exactly equivalent to an angular velocity around the Earth of 1°/hr., that is approximately 60 m.p.h. Errors in the Schuler pendulum are more complicated. So far the best results have been obtained using Doppler radar to give an independent measure of velocity, but the overall system is complex.

The signal applied to the gyro torque motor from the integrator will be proportional to the velocity of the vehicle over the Earth's surface. For times of flight of less than about one hour, damping of the 84-min. pendulum is of negligible importance as no method of damping can have much influence on the first half-cycle. If durations of less than 30 min. are being considered the error due to an initial disturbance of the pendulum will be roughly proportional to the cube of time.

With relatively short-range devices the accuracy of the accelerometer and integrator becomes of increasing importance relative to the accuracy of the gyroscope, although, of course, the accuracy of all components can be less than for the long-range cases. For very short periods and distances over which the Earth can be considered flat, it is unnecessary to precess the gyro at all, and quite crude components can be utilized. Such systems have, in fact, been proposed for measuring the take-off performance of aircraft where the time interval is less than 1 min. and the distance a few thousand yards. In this case, gyroscopes of quite conventional accuracy—about 10°/hr.—can be employed and the overall accuracy is decided almost entirely by the accelerometer and integrator, for which an overall accuracy of 0.1% is not at all unreasonable.

Civil Application

It is frequently argued that inertial navigation is of interest only for military activities because of the high cost and complexity of the equipment. In general, the equipment tends to be complex when the maximum possible accuracy is required from rather inferior gyros and accelerometers.

If really high-grade gyroscopes and accelerometers become available at a reasonable cost a rather different picture is presented. In the first place, the apparatus can become very simple because axis systems can be chosen which do not involve large amounts of computation. If the system is applied to an aircraft the stable platform automatically gives attitude and heading information, allowing some of the rather complicated systems which now exist to be eliminated.

Velocity information could be obtained as accurately as from commercially available Doppler equipments. The inertial equipment could present track and position information, possibly in the form of latitude and longitude, direct to the pilot or navigator, who would correct the position information manually as and when more precise fixes were available from other sources. A navigator of this type would allow instruments such as take-off monitors to be provided in a very simple manner and it could also be used as a smoothing element for VOR systems, so as to eliminate difficulties presented by the cone of confusion when flying over a VOR station, and to smooth ILS approaches.

Discussion

Mr. S. Scott-Hall, Scientific Adviser to the Air Ministry, opened the discussion by remarking on the amazing contrast between the accelerations and vibrations involved in launching a ballistic missile and the delicacy of the inertial equipment it carried. He asked about the precision required in inertial equipment and also requested details of the equipment proposed for civil aircraft.

Dr. W. Cawood, Deputy Controller, Aircraft Research and Development, M.o.S., suggested that the civil applications of inertial navigation might be limited. In his view, present-day civil aircraft had suitable navigation aids and now needed aids to prevent collisions, either in mid-air or with the ground.

Answering questions, Mr. Pateman said that the main difficulty with inertial systems for ballistic missiles was the effect of steady acceleration, which could cause gyro precession. There were also problems with the accelerometer which had to measure accelerations of 0.0001*g* in the presence of vibrations of 10 or 20*g*.

Speaking of civil equipment, Mr. Pateman said it would be much simpler than military inertial navigators as it need not allow for acceleration. It would have an accuracy of about 1 m.p.h. and would weigh less than 100 lb. The equipment would be regularly monitored by the aircrew. He could not commit himself on its cost.

Oxidant for British Rockets

PRODUCTION of high-test peroxide (HTP) oxidant for bi-propellent rocket engines is now proceeding at the new Warrington plant of Laporte Chemicals, Ltd. The £2,500,000 chemical plant is probably the largest of its type in the World, and its operation has doubled the company's output of HTP. The new process used will make HTP cheaper.

British rocket engines using HTP are the Armstrong Siddeley Gamma; de Havilland Super Sprite, Spectre and Double Spectre; the various Napier Scorpion engines and helicopter rotor rockets, and probably the small Armstrong Siddeley P.R.23 unit.

A 16,400-lb. to 19,000-lb. thrust four-barrel version of the Gamma, the Mk.201, powers the successful Saunders-Roe Black Knight space research vehicle (THE AEROPLANE, September 19 and October 10). The 500-lb. thrust P.R.23 is a tiny rocket first seen at the 1958 S.B.A.C. show and intended for attitude trimming of aircraft or missiles.

The Super Sprite is used for assisted take-off of the Vickers Valiant. The 7,000-lb. variable-thrust Spectre (THE AEROPLANE, August 23, 1957) was used in the Saunders-Roe S-R.53 mixed-powerplant research interceptor. In fixed-thrust form it is the assisted take-off unit for the Avro Vulcan and Handley Page Victor (THE AEROPLANE, February 7).

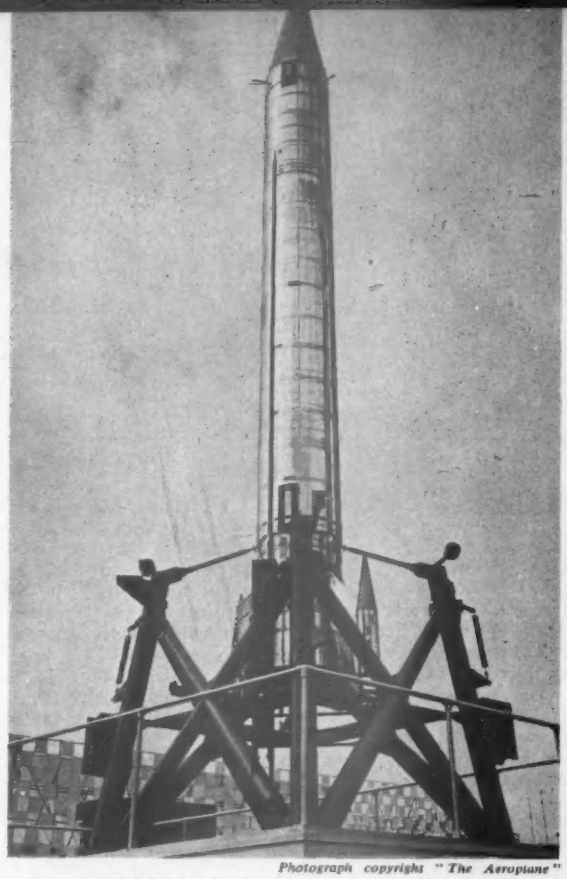
The Double Spectre D.Spe.D.1, consisting of a fixed-thrust Spectre D.Spe.4 atop a variable-thrust Spectre D.Spe.5, is almost certainly for the first Avro stand-off bombs (THE AEROPLANE, August 22).

The Scorpion (development of which was recently stopped) has been produced in single-, double- and triple-barrel forms (THE AEROPLANE, August 29). At one time it was destined for the English Electric Lightning interceptor. The N.R.E.19 helicopter rotor-tip booster rocket was fitted experimentally to the Saro Skeeter and first flight-tested in August, 1956. This unit was a monopropellent or "cold" rocket of the same basic type as the de Havilland Sprite.

All these British rocket engines (with the exception of the N.R.E.19) are of bi-propellent type and use HTP as the oxidant with kerosene fuel. Advantages of HTP as an oxidant are that it is non-toxic, non-poisonous and non-inflammable.

A further merit from the viewpoints of logistics and operational reliability is that, by taking simple precautions, HTP can be stored indefinitely in tanks without effective deterioration. It is a stable liquid which can be moved about or pumped with negligible risk to personnel.

By use of a simple catalyst, such as silver-plate gauze (or, less conveniently, a liquid such as calcium permanganate), the energy carried by HTP is released by decomposition into superheated steam and oxygen. This occurs at a suitable temperature



Photograph copyright "The Aeroplane"

KNIGHT PROPELLENT.—Black Knight, the successful Saro space-research vehicle, has an Armstrong Siddeley Gamma Mk. 201 rocket engine using HTP oxidant and kerosene fuel. The engine was designed at the M.o.S. Rocket Propulsion Establishment, Westcott.

NIGHT PRODUCTION.—At the new hydrogen peroxide plant of Laporte Chemicals, Ltd., at Warrington, production is continuous.

HTP at Warrington

FULL details may not yet be given of the new Laporte process for hydrogen peroxide production at Warrington or of the amount of HTP made there.

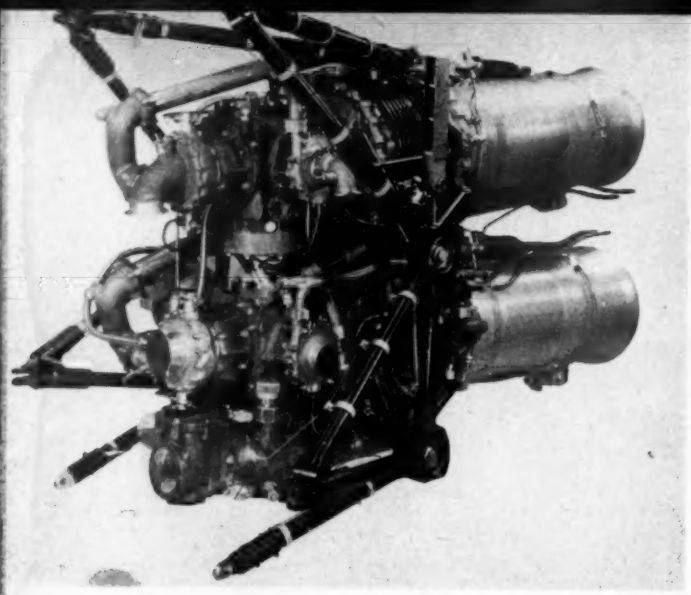
The process is based on the use of two-ethyl anthraquinone and was developed in a pilot plant at the company's Research and Development Department at Luton.

Hydrogen is made by "cracking" butane. In the presence of steam and a catalyst, the butane yields hydrogen and carbon monoxide, the latter being removed by reacting with steam over a catalyst forming hydrogen and carbon dioxide. By "scrubbing" with monoethanolamine, the carbon dioxide is removed and used as required for purging in an autoxidation process.

The hydrogen is passed over a catalyst and the carbon-monoxide content is further reduced with the formation of methane.

The autoxidation process organic cycle takes place in two identical units operating in parallel up to the extraction stage where solution from both streams is mixed. At this stage the solution is about 20% hydrogen peroxide which can be used directly for certain purposes, but is normally further purified and concentrated to between 50% and 90% hydrogen peroxide by distillation.

An adjoining distillation plant vaporizes the fluid which is passed to a separator. The vapour is fractionated to yield a concentration of 50%-70% hydrogen peroxide. Part of the production of these stills is further purified and becomes 85% to 90% hydrogen peroxide or high-test peroxide (HTP). In addition to rocket engines, HTP is also used as a propellent for torpedoes and for two experimental submarines of the Royal Navy.



PAIRED PUSH.—The de Havilland Double Spectre rocket engine uses HTP oxidant and kerosene fuel for the fixed-thrust upper and variable-thrust lower units.

for driving a turbine wheel or igniting fuel (such as kerosene) which burns with the released oxygen when injected into the products of decomposition. By decomposing the HTP prior to injection, safe and smooth thermal ignition is obtained.

This is one of the big operational advantages of HTP in that neither electrical nor spontaneous chemical ignition is required. The latter form is very effective, but is correspondingly the most dangerous. Rockets using nitric-acid oxidant and furfuryl alcohol fuel produce spontaneous chemical ignition which, although efficient, has proved somewhat temperamental in practice and has resulted in a swing to the other extreme of solid propellents for large missile sustainer engines in addition to the common use of solid rockets for boosting at launching.

Another form of rocket is that using electrical ignition with nitric acid or liquid oxygen oxidant and kerosene fuel. British engines of this type were the Armstrong Siddeley Snarler and Screamer. A large engine of this type from the U.S.A., now being built by Rolls-Royce for the de Havilland Blue Streak LRBM weapon, is the Rocketdyne liquid-oxygen rocket.

Nitric acid is a very unpleasant substance which is highly toxic and corrosive. Its mixing with fuel outside the combustion chamber causes a fire or explosion, as has been frequently demonstrated in the U.S.A.

Liquid oxygen has an exceptionally low boiling point. Therefore it constantly evaporates at ambient temperatures and requires that any missile so powered must be fuelled-up at the last possible moment.

From these considerations it can be seen that the advantages of using HTP extend beyond the safety requirement for a piloted aeroplane (or its auxiliary engines for take-off) into the urgent need for reliability, ease of logistics support and operational efficiency for certain types of missile.

Were this not the case it would be illogical for Laporte Chemicals to invest heavily in a new plant for the production of hydrogen peroxide including HTP.

It would not be unreasonable to deduce that official thinking is for further use of rockets using HTP as the oxidant, particularly since the first and completely successful firing of the Black Knight at Woomera. In this context of missile firings in Australia it should be noted that one of the subsidiaries of Laporte Industries, Ltd., is Laporte Chemicals (Australia) Pty., Ltd.

ROTOR BOOSTER.—Diminutive in size, the Napier N.R.E.19 monopropellent boost-rocket for helicopter rotor tips gives a thrust of 20 lb. to 100 lb. It was fitted experimentally to a Saro Skeeter with an HTP tank above the rotor head.

However, the supreme requirement for a ballistic missile is performance—rather than the safety and reliability essential for a research vehicle, the engine (whether main or auxiliary) of a piloted aircraft, or the guided weapon launched from a piloted aeroplane. On these grounds it would be wrong to imply that new rocket engines using HTP were in the offing, for ballistic or other guided weapons, although there may well be further examples of cases where the special merits of HTP as an oxidant decree its use.—D.G.

Defence Radar Simulation

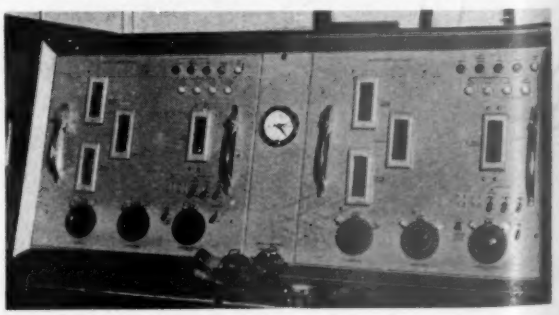
LAST week the first radar simulation system to be built by Solartron Radar Simulators, Ltd., a member of the Solartron Electronic Group, Ltd., was demonstrated at the company's new establishment at Farnborough, Hants. Planned to be dispatched to the Italian Army authorities this month, the equipment, valued at £125,000, is the first of a number ordered by various European Governments and can be employed for air-defence training, airport and flying control instruction and similar exercises.

The system demonstrated simulates a medium-range search radar and feeds synthetic signals, representing radar stations, attacking and defensive aircraft and electronic counter-measures into unmodified PPI displays of the type used with live radar. Twenty air targets are incorporated in the Italian equipment and consist of 14 aircraft, which can be allocated as bombers or fighters as required, four "window" radar jammers and two parachuted noise-generating jammers.

The aircraft targets are grouped in pairs in console arrangement, so that one operator may control two aircraft. Initial starting position, speed, rate of turn and rate of climb or descent of the aircraft can be set by the operator together with limiting performance figures of the type being simulated. Indication of aircraft position on a cartesian grid, heading and height, are given to the operator by means of large edge-on dials on the target control units which form the central section of each console. Aircraft slant-range distance, bearing and elevation angle are indicated by similar dials on the front of the computers which flank the control units.

At the demonstration an exercise representing a series of attacks on an airfield some 30 miles south of the radar site was set up. The range of the radar simulated was 60 miles, and sections of fighters were directed on to bombers attacking from the north at approximately 600 knots. Parachuted noise jammers were simulated, and the exercises were conducted by two controllers, one directing the attacks and the other controlling the defence forces. During a training exercise the bomber controller would be the tactical control instructor, and the students under instruction would operate the interception control displays as ground controllers.

In addition to the facilities described in this Italian equipment, Solartron radar simulators can incorporate other features. These include the calibration of air targets in Mach number, and fitting them with fuel-state indications which are continuously computed, with additional reference to engine setting and aircraft operating-height values. Height-finding radar simulation and, for ATC personnel training, precision approach and airfield control radar can also be simulated.



The central panel of the Solartron radar simulator console for positioning and controlling air targets on the PPI display. Each console operator may control two aircraft echoes.

News of Industry

Viscount Test-Rig

FOR testing hydraulic components of the Vickers Viscount and Viking, a hydraulic test-rig has recently been supplied to the Misrair airline of Egypt by Rodger, Setterington and Partners of Western Avenue, Ealing, W.5.

The rig operates with hydraulic fluid to specification D.T.D. 585. Suitable connectors and adaptors are provided for attachment of the components to be tested and has all necessary instruments for systems checking.

Two Lockheed Mk. 7 pumps provide hydraulic power. Each is driven by an electric motor of 7.5 h.p. through flexible couplings and delivers 2.5 gal./min. of fluid at 3,000 p.s.i. The combined output is required for testing Micronic filters, but for other purposes the pumps can be used separately. A 20-gal. tank contains the hydraulic fluid.

Outside the main test-rig is the means of testing the hydraulic pump used on the aircraft. The pump for this purpose is driven by a 15-h.p. electric motor through a flexible coupling. Pump speed can be varied between 488 and 4,395 r.p.m. by a remote control. Low rates of flow at pressures up to 10,000 p.s.i. can be tested by using a hand pump mounted on the rig.

Fatigue Data Sheets

THE Royal Aeronautical Society has produced a series of data sheets on structural fatigue, similar in format to the Society's well-known data sheets on structures, aerodynamics, performance and fuels and lubricants. They are available at £2 6s. per set from the Society at 4 Hamilton Place, London, W.1.

Although aimed primarily at the problem of aircraft fatigue, these data sheets will be useful in the design and development of all products which may be subject to fatigue. They will be revised and reissued when necessary.

This first issue of fatigue data sheets includes an introduction and index. Titles of the sheets are:—

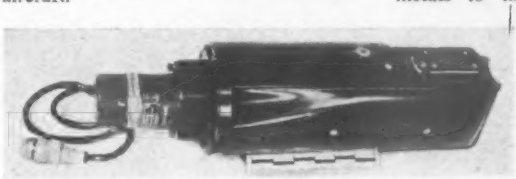
Terms and notation for aircraft structural fatigue; Short bibliography on fatigue; General principles of design in relation to fatigue; Average gust frequencies; Endurances of complete wings and tailplanes; Endurances of structural joints (aluminium-alloy material—tensile loading); The effect of mean stress on fatigue strength (plain test piece); The effect of mean stress on fatigue strength (test piece with stress concentration), and Information on the use of data sheets on stress concentration.

The last eight sheets give information on:—

Geometric stress-concentration factors for holes in flat bars or strips, notches in flat bars or strips,, diametric holes in solid circular rods, circumferential grooves in solid circular rods, fillets in a flat bar or strip in tension, a loaded pin in a central circular hole in a flat bar, external fillets on round tubes under axial tension and fillets in a flat bar or strip in bending.

Guided Weapons Trials Camera

A CAMERA which is mounted on a target for guided-weapon trials is now in quantity production at the Salisbury Division of the Fairey Aviation Co., of Australasia, and has been designed by, and developed jointly with, the Weapons Research Establishment at Woomera for use on the Jindivik and other target aircraft.



The Fairey wide-angle lens camera for guided weapons trials.

In the Jindivik installation, cameras are mounted in pairs, either end-to-end in wing-tip pods or back-to-back in a fairing which projects from the leading edge of the wings. One camera of each pair normally faces vertically upwards and one vertically downwards. Full coverage is obtained with this arrangement by virtue of the ultra wide-angle lenses employed, which have a field of view greater than 180°.

Cameras are flange-mounted to a centre section which attaches to the aircraft wing, and each camera is enclosed by a fairing which in some cases also houses flares. Camera light-proofing is independent of these fairings. Provision is made for installation adjustment of each camera, and clinometer planes are provided for setting up. The running speed is about 100 frames/sec. and the exposure time is one millisecond.

Two neon lamps for timing and event marking are incorporated in the unit along with thermostatically controlled heater elements. The electrical supply is from 26 to 28V. DC. The weight of the camera unit is 14¼ lb. and the maximum diameter 5.3 in.

Forging of Difficult Materials

DANIEL DONCASTER AND SONS, LTD., of Penistone Road, Sheffield, 6, has produced a brochure describing the company's resources and its experience in the forging of materials such as titanium, Nimonic, zirconium, aluminium bronze, heat-resisting alloys and high-permeability iron. The brochure is intended to assist companies which are considering the application of the newer metals to their products. Doncasters offer their assistance in the design as well as the production of components in these materials.

Other activities of the company which are described are the production of precision-forged compressor blades and turbine blades for gas and high-temperature steam turbines; the manufacture of hardened forged-steel rolls for cold rolling, and Doncaster work on powder metallurgy.

Copies of this brochure can be obtained on request from the publications department of the company.

Glass Cloth in 3-D

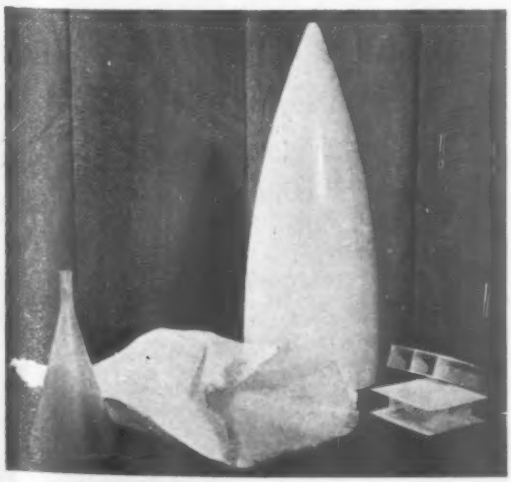
BIG savings in laying-up time during the manufacture of glass-cloth reinforced plastic radomes and other parts are made by the use of a three-dimensional weaving technique. Developed by the Raymond De-Icer and Engineering Co., of California, the new technique is to be used in this country by Fothergill and Harvey, Ltd.

Previous practice has been to produce such mouldings as radomes by laying-up the glass cloth reinforcement by hand, the fabric being cut into strips and gores which are butted together on the mould. The method is satisfactory, but requires a great deal of labour and does not produce complete consistency of end-products, thereby adversely affecting radar performance.

The Raymond technique of weaving involves the use of a punched-card control system. Stations are set out at suitable intervals on the surface of the shape to be produced and the circumference computed. The fabric is woven in flattened tubular form.

Lengthwise yarns (warp) are controlled by a cam so that precise dimensions are kept. For special applications extra warp yarns and a heavier weft (crosswise) yarn can be used to give extra local reinforcement. In the same way, fabrics of progressively changing thickness can be woven to give a tapered wall in the finished moulding.

The system can be used to produce asymmetric mouldings in addition to conical radomes, such as special radar antennæ.



A typical reinforced plastic missile nose cone with, in front, one of the three-dimensional woven 'socks' from which it is made. Also in the picture are a funnel-shaped radar component and a sample of woven box-form panelling.

(*Continued from page* 815)

STRIKES—CONTINUED. — At the time of going to press, the strike situation in the U.S. airline industry was as follows: T.W.A., all services grounded by strike of I.A.M. mechanics since November 20. Eastern Airlines, all services grounded by strike of Flight Engineers International Association members (flight engineers) and I.A.M. mechanics. F.E.I.A. took action on November 24 after Eastern agreed with A.L.P.A. that the third man in Electra and 707 cockpits should be a pilot. Strike against American Airlines was threatened by A.L.P.A. over "third man" and pilots' pay issues. Lake Central Airlines' cabin attendants struck on November 23 and services were reduced. West Coast Airlines agreed wage increases for I.A.M. mechanics on November 24 after three-day strike and resumed normal operations.

COMET SERVICE.—B.O.A.C. plans to use Comets on the London-Montreal service once a week from December 19. Bookings on the Comet Monarch service from New York to London for December and January show an increase of 50% over the same period a year ago.

BAGINTON PLANS.—Provision of paved runways, one of which could ultimately extend to 9,000 ft., is one of the principal proposals in a four-stage plan for the development of Baginton, Coventry, as an international airport. Plan, approved by the council's Aerodrome Committee, involves expenditure of £476,500 in the first stage. M.T.C.A. has refused, at present, to provide Customs facilities at Baginton.

ANOTHER CARAVELLE. — Air Algérie has exercised its option on a fourth Sud-Aviation Caravelle, bringing the total number on order to 50 plus 16 options.

INDEPENDENT DC-6As. — Eagle Airways will use their DC-6As next year on night tourist services to Pisa and Rimini and on week-end services to La Baule and Dinard.

News About People

H.P. OCCASION. — Marshal of the R.A.F. Sir Dermot Boyle, Chief of the Air Staff, congratulates Mr. J. Radcliffe on gaining a fifth-year engineer apprentice prize after presenting awards to Handley Page's engineer and trade apprentices on November 21.

GUIDED-WEAPONS TRIALS.—Air Cdre. W. R. Brotherhood is to succeed Air Cdre. B. A. Chacksfield as Director of Guided Weapons (Trials) at the Air Ministry at the end of this year.

INSTRUCTION AT ELSTREE.—Mr. William Bailey, C.F.I. of the Elstree Flying Club, is vacating that post and will be replaced by Mr. E. Wild as from January 1. Mr. John Schooling, at present a flying instructor, is shortly to take over from Capt. E. Brook-Williams as chief ground instructor.

WRIGHT LECTURE.—M. Maurice Roy, director of the Office Nationale d'Etudes de Recherches Aéronautiques, is to deliver the 22nd Wright Brothers Lecture at the Smithsonian Institution, Washington, on December 17. His subject will be "Means and Examples of Aeronautical Research in France."

KRONFELD OCCASION.—At the Kronfeld Club in London on December 9, Mr. Maurice Imray is to be presented with a gift on his retirement as honorary secretary of the Popular Flying Association. As we have previously announced, he is now devoting more time to R.Ae.C. matters, and Mr. H. Best-Devereux is now the working chairman of the P.F.A.

AVRO MANAGER.—Mr. Harry Dobson has been appointed works manager of A. V. Roe and Co., Ltd. He is the son of Sir Roy Dobson, managing director of the Hawker Siddeley Group.

A. V. M. STEVENS.—The death of Air Vice-Marshal C. A. Stevens, C.B., C.B.E., M.C., occurred on November 30 at the age of 60. During the First World War he transferred from the Army to the R.F.C. He was in India from 1924 to 1930; with H.Q., No. 11 Group in England in 1936 he was concerned with early radar applications. In 1941 he became S.A.S.O., Balloon Command, later holding a similar post with No. 9 Group, Fighter Command. From 1944 he served with 3rd T.A.F., and at Air H.Q., Burma, and in 1945-46 was A.O.C. Allied Air Forces, in the Dutch East Indies. From 1951 to 1954, when he retired from the Service, he was S.A.S.O., Home Command.

DUTCH SERVICE.—In recognition of his distinguished services to the Netherlands aircraft industry, Mr. E. G. Parramore, the Plessey International, Ltd., representative in Amsterdam, was recently presented with the Knight's Medal of the Order of Orange-Nassau by Commodore L. Proost, R.Neth.A.F.

Military Aviation Affairs

GOODWILL VISIT.—Last month two Vulcans of No. 83 Squadron visited Ankara during a flight to Malaya. Left, Gen. Goker, C.-in-C. Turkish Air Force, getting into a Vulcan with Wg. Cdr. L. F. Banks (bottom of ladder) and his crew for a flight over Turkey. The Force was led by Air Vice-Marshal G. A. Walker, A.O.C., No. 1 Group, Bomber Command.

JORDANIAN HUNTERS.—Delivery of the 12 Hunter 6s from the United Kingdom to the R. Jordanian A.F. was completed last week. The aircraft were a gift from the United States Government.

FAR EAST DEFENCE.—A second U.S.A.F. squadron of F-104A Starfighters is to be sent to Formosa. The 337th Squadron is to be transferred from Westover A.F.B., Massachusetts, to the island this month.

ARMY FLYING.—Helicopters from the Army Air Corps Centre at Middle Wallop are to be used for operations in Cyprus, and will be flown out to the island in Transport Command Beverleys.

SERVICE COMPLETED. — The Australian Commonwealth Wirraway, which has been the basic R.A.A.F. trainer since the 1939-45 War, is being withdrawn from service.

Book Reviews

C.F.S.—BIRTHPLACE OF AIR POWER. By J. W. R. Taylor. 222 pp., 5½ in. by 9 in. Illustrated. Putnam and Co., Ltd. Price 21s.

BY writing his history of the Central Flying School, John Taylor has done an excellent job for posterity. Perhaps the first thing that strikes a reader is the amount of material which must have been collected and considered by the author when he was doing the research, and the difficulties that he must have had in deciding what was to be included. His skill in eliminating the unnecessary and his ability to include sufficient background of history to give a sense of proportion makes it excellent reading. He has not allowed the personal anecdote, the names of the great, or the sometimes incredible incidents to overpower his sense of history.

In this story of C.F.S. he gives the story of the Royal Air Force as we know it today, the birth pains, the first steps, the technical and personal troubles, the politics, the battles with ignorance, and the triumph of imagination. Almost the first half of the book is given over to historical background, and is therefore the story of the Royal Flying Corps and then of the Royal Air Force itself. The page of acknowledgments at the beginning alone reads like an aviation who's who, and should convince the reader of the value of the pages that follow.

This reviewer found the early part of the book every bit as interesting as that which described events of more contemporary times. There are many things and many occurrences which stand out as remarkable, but they are too many to be catalogued in a review, however strange they seem today. Not the least is the light-hearted manner in which aviators of those days learned to fly, and even accepting the fact that the aeroplanes themselves were slow and much easier to handle, it is remarkable that there were not more fatal accidents.

Even the first C.F.S. commandant himself, Godfrey Paine, could have had very little idea of what it was all about when he took command. In mid-April, 1912, he was sent for by Mr. Winston Churchill, then First Lord of the Admiralty, and told that if he wanted to take over the job of commandant at the Central Flying School he must learn to fly before May 1. This he did, in 10 days, and having made four figures of eight in the air, he was considered a complete aviator.

Another interesting item was in the report which Capt. Paine submitted to the Director of Military Training, in which he gave a list of the lectures attended by the first batch of pupils. Of these lectures there was only one on practical navigation.

However, it is not until Chapter III of the book that one comes face to face with the man who was really ultimately responsible, not only for the successful infant years of the Central Flying School, but for the subsequent stature of the Royal Air Force itself, the then Major Hugh Trenchard. He, too, took his ticket at Brooklands in something like 10 days, and was posted to the Central Flying School about the end of July, 1912. Thereafter his name and personality run constantly throughout the book, and if at the end one is left with any regrets it is that Lord Trenchard himself did not live long enough to be able to supply memories of his own or to read what is really another monument of his extraordinary ability.

Chapter VI deals with another most remarkable character, Robert Smith-Barry, a man whose influence on the practical flying of subsequent generations of airmen—on a world-wide scale—was profound. One hopes, too, that future leaders of the Royal Air Force will read the remarkably precise and perspicacious reports which he submitted to support his contention that flying training required not only specialized instructional skills, but special flying techniques of its own.

Apart from his great foresight, he, too, breathed an *esprit de corps* into the School of Special Flying at Gosport that has survived all the changes and vicissitudes that make up the history of the Central Flying School.

In his book, Mr. Taylor has shown particular skill in bringing out the specialized approach to flying that there always was at the Central Flying School—whether at Upavon or Wittering or Little Rissington. This approach is difficult to define and, until one had experienced it, difficult to understand.

It was not, as is sometimes imagined, the devil-may-care approach of the young and inexperienced aviator, nor one that underestimated the inherent dangers that are always present in flying (of any sort). It was, rather, a complete understanding of what an aeroplane was, how it worked, and why a particular type of aircraft was as it was.

There was an acceptance of the fact that the air, like the sea, was an unforgiving mistress and, although you got no second chances if a bad mistake was made, it was never necessary to make a bad mistake if certain fundamental rules were fully appreciated and followed. If mistakes were made (these being unavoidable) they had to be recognized for what they were, and the necessary corrective action taken instinctively and immediately. This was really the teaching of a complete and disciplined harmony between pilot and machine.

But Mr. Taylor also shows the other side of the coin when he describes the somewhat startling highlights of the traditional "Instructor's Ten Minutes," a morning procedure (normally the time when aircraft were being flight tested) when flying rules were discarded and chaos reigned. On more than one occasion senior officers who witnessed this abandonment of flying discipline were heard muttering words that sounded like "Disciplinary Action," but nothing ever came of them. They perhaps envied this wild 10 minutes and realized it undoubtedly did an enormous amount towards creating and maintaining confidence in both instructors and pupils.

Towards the end of the book, Mr. Taylor has a real problem on his hands in trying to follow, and maintain the interest in, the changing fortunes of the Central Flying School throughout the latter years of the last War. Also the post-War story seems to the writer to be the least interesting, but here one must plead personal prejudice. It is always the more interesting to read about the people one knew and the things one did oneself in the days of one's youth. Nevertheless it is certain that those who so nobly carried on the Central Flying School tradition in the difficult post-War days up to the present time will find the later pages every bit as exhilarating as what has gone before.

There are of course many, many people who are not mentioned in the text of this book but whose work contributed as much to the greatness of the Central Flying School as those whose names are better known and which appear with some frequency. If Mr. Taylor had been able to stretch his net more widely, this reviewer would like to have seen greater mention of the work done by the Sergeant-Pilot instructors. Many of these men not only did a fine job when at the Central Flying School but subsequently got their commissions and finished up in high rank. Although it would be invidious to mention them by name in a review, some acknowledgment of their work should perhaps have been made in the book.

Another criticism (and this is one which applies to many books and is perhaps a "nuts and bolts" problem indigenous to publishing) is that the photographs (and one wishes there were more of them) are not positioned in accordance with the text but are badly mixed up both in places and dates, so that one gets a photo of a post-War review of aircraft in close proximity to some taken in 1924.

Be that as it may, however, this book should be read and remembered, not only by all those who are interested in the history of Air Power, but by those who really want to know about the stuff of which the Royal Air Force is made.—"A1."

SKY SMUGGLERS. By Geoffrey Williamson. 176 pp., 5½ in. by 9 in. Robert Hale, Ltd. Price 16s.

FROM time immemorial smuggling has been practised with varying degrees of ingenuity and success by all manner of people. When air travel became a practical possibility a new range of opportunity was opened up for those who try to evade the Customs regulations, either as a business or as an occasional lapse. "Sky Smuggler," as its name implies, reviews the whole field of aerial smuggling—and, for a documentary, makes fascinating reading.—F.T.M.

HIGH ALTITUDE AND SATELLITE ROCKETS. 136 pp., 9 in. by 11¼ in. Published jointly by The Royal Aeronautical Society and the British Interplanetary Society. Price 32s. 6d.

THIS book is the official proceedings of the symposium of the same title held at the College of Aeronautics at Cranfield in July, 1957, under the auspices of the two learned societies. As such it is a collection of 12 authoritative papers by British and American authors on all aspects of the overall subject. It contains, too, the statement made by Prof. Petrov outlining the U.S.S.R.'s contribution to the I.G.Y. A most useful biographical section is included to give details of the eminent lecturers; and there is a list of members who attended the symposium.—F.T.M.

ELECTRICITY IN AIRCRAFT. By F. G. Spreadbury. 342 pp., 5½ in. by 8½ in. Constable and Co., Ltd. Price 40s.

IN this book the author—who is a lecturer in mathematics and electrical science—covers in some detail aircraft electrical equipment subsequent to that of 1945. The book is intended for intermediate-level study and has been written for "electrical engineers, technicians and ground service staff specializing in all aspects of aircraft electricity."—F.T.M.

Private Flying

H.J.C.'s CLUB COMMENTARY

● ABOUT three months ago the **Yorkshire Flying Club** came into being as a successor to the former Yorkshire Aero Club, the demise of which was reported in these pages last April. The new club has continued to use Sherburn-in-Elmet aerodrome under a short-term lease from the Air Ministry, but that has now expired and the club hopes to make its headquarters at a private landing strip at Dunscroft, near Doncaster.

This new site might prove to be better placed than Sherburn, as most of the members live in South Yorkshire, and efforts are being made to get permission from the local planning authority to put up a hangar to house the three aircraft. The secretary of the club is Mr. Harry Maw.

CLOSE QUARTERS.—This attractive J.A.P.-powered single-seat ultra-light has been designed by Mr. John Taylor of Ilford, Essex, and built, with the assistance of his wife, in the living room of his upstairs flat during the past year. Its completion is imminent, but flying it will not be a fraction of the problem involved in extricating it from its birthplace.

Photograph copyright "The Aeroplane"

● LESS encouraging news from Yorkshire concerns the **Yeadon Aero Club**, which, following the acquisition of Yeadon aerodrome for development as the Leeds-Bradford civic airport, has been given notice to quit the terminal buildings by the end of this year.

This means that, with the closing of the clubhouse and restaurant, social amenities will be restricted, and it is reported that Yeadon Aviation, Ltd., which operates the club, may go out of existence when the Joint Aerodrome Committee takes over.

● THE LATEST club to use a Chipmunk is the **Denham Flying Club**, which has just received G-AOTP, a Mk.22A, and is finding it popular with members. The hourly rate is £5 10s.

The club also has two Hawk-Trainers in operation, an Auster Alpha and an Aiglet. In view of the threatened suspension of the rebate on petrol tax the club has had to increase flying rates on these aircraft by about 10s. an hour.

The club recently arranged an inter-club goodwill tour to Stapleford, Luton, Sywell, Kidlington and back to Denham, but so far the weather has not been good enough for this "Operation Tryitout," as it is called. The idea is that if it proves popular with members it will be extended during the summer.

On the instructional staff of the club Jimmy Hamilton and Adrian Vaughan have left and been replaced by Jim Ward, with George Parker assisting at week-ends. Miss Daphne Steward has become Mrs. Holt and has also left, her duties being taken over by Miss Valery Hicks.

● AT EXETER the annual general meeting of the **Exeter Aero Club** was held on October 28, and the general committee now consists of R. Daw, R. W. Innalls, P. Morgan, Miss S. Savory, J. Stewart, Mrs. S. Swithenbank, R. W. Weaver and H. Williams. Denis King was elected chairman, and Mr. Innalls vice-chairman.

The chairman reported that 2,389 hr. had been flown last year. The Bennett Trophy for Airmanship was presented to Ivan Fisher, and the Parkhouse Trophy for Air Navigation to Denis King.

Two R.A.F. Chipmunks have been made available to the club under the A.T.C. air-experience scheme and training staff is being assembled.

Recent first solos have been flown by J. Erlam and G. Perry-Keene.

On December 12 the club is to hold its Christmas Dance, with the children's party on December 22.

Gliding Notes

by Dr. A. E. Slater

BLACK thermals may soon be added to the soaring pilot's vocabulary, which already includes "green air," meaning rising air which is indicated by the green ball in a variometer, and occasionally "blue thermals," which are thermals formed under a completely blue sky with no clouds in their tops. But, unlike these symbolic colourings, black thermals are literally black.

A certain Dr. Florence van Stratten, according to a newsletter from the Soaring Society of America, has been working on the "creation and destruction" of clouds by seeding them with carbon black. The idea is not to make water vapour condense, but that the Sun's radiation is absorbed by the black particles, which then pass on their acquired heat to the surrounding air. The result is a thermal.

* * *

Naturally, this suggests the possibility of creating thermals artificially just when and where the sailplane pilot wants them, and the *S.S.A. Bulletin* suggests that his ground-crew should rush on ahead of him to start up thermals at intervals along his course. He could, of course, throw out the soot himself, but both he and his machine might need a good scrub down at the end of the journey.

The blackest thermal ever recorded was described by Robert Swinn in an article about dust devils in Egypt, published in *Gliding* for Autumn, 1952. He was taking nibbles at one in a French Air-100 when its base crossed a large store of coal belonging to the State Railway. The black dust climbed up through the dust devil "at an alarming rate," and when it reached Swinn's level he managed to get into the centre and look down through a sort of hollow chimney with black walls, there being evidently a downcurrent in the central core. It is significant that when the bottom end of the blackness had taken off from the ground and risen to his level, that was the end of the lift—which suggests that the black part of the thermal had gone up so fast as to leave the rest behind.

One is reminded of a scheme proposed by Dr. Spilger to the OSTIV meeting of 1952, held during the World Championships at Madrid. He wanted to promote thermals in desert regions by covering certain bits of ground with black material, which would absorb the Sun's heat more than the rest of the desert surface and start off good-sized thermals. As it is, he said, deserts are so uniform that there is no reason for thermals to start in one place rather than another, so they do not start at all; only a small amount of the overheated air goes up in dust devils and the rest stays on the surface and prevents vegetation from growing.

* * *

A PRESCELLY Gliding Club has been formed with headquarters at Crymmych. This probably means nothing except to those who live around the far end of South Wales, and even they may not have heard of Crymmych, a tiny village eight miles south of Cardigan on the road to Tenby. But Mynydd Prescelly, a ridge seven miles long, stretching westwards from Crymmych, rises at its summit to 1,760 ft., the highest point in Pembrokeshire. Here, the north slope looks steep enough to be soarable for about a mile, but probably the most effective place for soaring is an east-facing bowl formed by a southerly projection from the main ridge.

* * *

Mr. H. Kuchling, of Hebron, Whitland, is the moving spirit of the club, but among its 50 members he is the only one with gliding experience, having got his "C" at the Midland Club. He picked up two Kirby Cadets when the Air Ministry was selling them off for a few pounds each after abolishing their use in the Air Training Corps. Being due to visit friends in the district, I went at a week-end in the hope of seeing the club in action, only to discover that both Cadets had been blown over on the ground a week or two before and, what with winch trouble as well, there was nothing doing.

The new club is not far from the rocket base at Aberporth, whose personnel might well be induced to help, though perhaps not to the extent of providing an obvious substitute for the winch.

The local paper reports an assertion that this club is "the first venture of its kind in Wales"; but there was a rather similar club in Pwllheli before the War, run by E. R. Wilson, of the staff of Boots' in Pwllheli. It had a single primary glider, frequently in need of repair.

Correspondence

What We All Want

PEOPLE who use private light aircraft will read with interest your article on "Farming by Helicopter" on page 762 of your issue of November 21. A light helicopter is what we are all waiting for.

The cost of £8,050 is a little off-putting, as also the cruising speed of 45 knots, and endurance of 1 hour.

What gives food for thought, however, is the statement that a total of 75 acres can be sprayed in an hour at a cost of 35s. per acre, plus chemicals. Multiplying 35s. by 75, we get £131 5s., being the cost of an hour's spraying. If this cost represents fuel, then it comes to well over 1,300 gallons of, presumably, paraffin—weighing some 4 tons.

Could we have the real fuel consumption, please, and running cost per hour of this attractive little helicopter?

St. Ives, Cornwall. H. TEMPEST.

[This figure obviously includes overall costs of operating the Kolibrie, with such items as depreciation, insurance, pilot's salary, and other overheads. Representative fuel-consumption figures are quoted in our article on pp. 824-5 on "Flying the Dutch Kolibrie."—ED.]

More Airports Doomed?

MOST of us who work for a livelihood in British civil aviation will have nothing but sympathy for the Croydon Airport operational tenants. However, their troubles are not isolated. Now, here in the North, Liverpool and Blackpool aerodromes are threatened with early closure or take-over by local authorities. The latter aerodrome has been famous in aviation since the first flying meeting in 1909.

Over the past 12 years at Blackpool, eight concerns have gone out of the aviation business and each year the aerodrome becomes more of a general trading estate; and with the restrictions now wittingly or unwittingly placed by the Ministry it is not possible to achieve anything like an economic utilization from our aircraft. We therefore have to look away from Blackpool to effect a sensible usage.

We, the "oldest inhabitants," have supported Squires Gate Aerodrome since the M.C.A.'s first year and if we had invested part of our gratuities in a crystal ball, I have no hesitation in saying that the thousands of pounds we have largely wasted on accommodation charges would have been put towards a privately controlled flying field.

A lot of the Ministry boys lack practical experience and rely too much on the "book," and lack that (as far as the M.T.C.A. is concerned) uncommon quality called common sense. Once upon a time we had a senior official here who seldom had to use his "book." Movements increased, life was brighter. He exercised both experience and common sense and was like a breath of fresh air in a stuffy room, but the windows were again soon closed—he was quickly posted.

The time is ripe for Mr. Harold Watkinson to recruit a representative Committee of Operators and M.T.C.A. experts to get together in friendly fashion to discuss and encourage energetic action over the many and varied problems which face both the Ministry and the operators.

I think that such teamwork, wholeheartedly given on both sides, would achieve better results than the formation of a M.T.C.A. Tenants Association. The formation of such an association could result in more battle than progress.

I should like to hear other views on this subject. What about it, Mr. Watkinson?

RUSSELL L. WHYHAM,
Air Navigation and Trading Co., Ltd.,
Squires Gate Aerodrome, Blackpool.

[Earlier this year the Public Accounts Committee recommended that the M.T.C.A. should give up its ownership of Blackpool Airport. Discussions have been held with a view to Liverpool Corporation assuming responsibility for Liverpool Airport.—ED.]

Comparisons Not Odious

AS a frequent reader of THE AEROPLANE, I feel compelled to congratulate you on a most comprehensive review of flying in general.

THE AEROPLANE in the past has published reviews of such things as the British aircraft industry in general but, however, as is the case in most magazines of this type, one never finds any comparison of one aircraft with another, especially if the two aircraft have different countries of origin.

I should therefore like to make a suggestion for such an article, one which I have often hoped to find in THE AEROPLANE; that is an article comparing the performance, details of design, and many other features, with plan views and photographs of the military aircraft and missiles of Britain, U.S.A., France and the U.S.S.R., with a comparison of points for and against with other aircraft of the different nations.

Ratcliffe College, Leicester. F. MASKREY.

[Valid comparisons between military aircraft are extremely difficult to make, as it is usually impossible (for security reasons) to obtain reliable data. THE AEROPLANE has, however, done a great deal towards providing comparative material for civil aeroplanes. See, for instance, the Commercial Aircraft Number (July 4, 1958), in which precise details of the World's transport aeroplanes are presented to a common standard.—ED.]

Groundabout

Operation Noël—Phase 1. The Christmas spirit still prevails. Already the calendars and diaries are coming in. Shorts have lived up to their motto "At Shorts ideas take shape on time." Not only was their diary the first to arrive, it starts with October, very useful. And Air France follow up their "World's Largest Airline" claim with the World's Largest Calendar, beginning with December. This reminds me that New Zealand National Airways Corporation really get in first by distributing their June-to-May calendar in mid-summer, although I'm never quite sure whether they're late for last Christmas or early for the next one.

*

Très Gentille. Helicopter Sales, Ltd.'s Christmas gift has demonstrated to me that (a) they beat their delivery dates (I received their handsome musical cigarette lighter last week); (b) they are smart salesmen (it plays "*Gentille Alouette*"); and (c) they carry ample spares (a u/s music-box part was replaced immediately from stock).

*

How to Deal with Wrenegade Childwren. This column's recent reference to the Bigger-Baskets-for-Prosperity Crusade reminded an R.A.F. friend that at Idlewild incoming passengers are provided with wheeled baskets for transporting their paraphernalia to the Customs benches. They (the baskets) bear this notice: DO NOT LEAVE UNATTENDED CHILDREN IN TOP COMPARTMENT.

*

Up the Rotarians. There are those in Whitehall Gardens who think that the Air Ministry should establish a helipontoon in the Thames just across the Embankment, perhaps appropriately alongside the R.A.F. memorial there. It would set an example to the civil authorities and eliminate those dreary road journeys to airfields which waste so much of senior officers' valuable time. After all, it is still the Royal *Air* Force.

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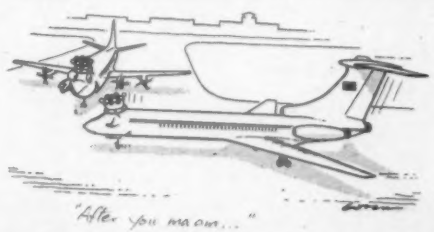
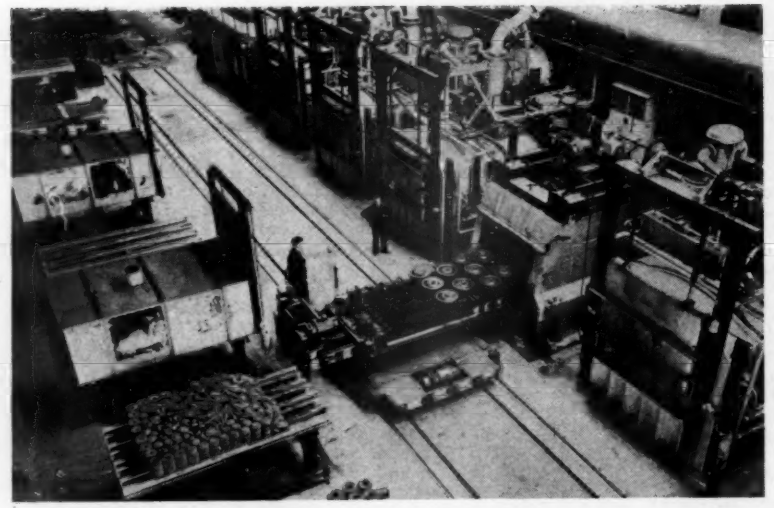
Rule Proved. The usual official disregard paid to names suggested for new aircraft by enthusiasts seems to have had an exception in the case of reader Maurice Tuckey. He put up the name "Hunter" for Hawker's fighter and, by heaven, that's what it was called. Other



good names he's offered are P.1 Eagle, NA.39 Sea Phantom, VC.10 Jupiter and one that I especially like, the DH.121 Duchess.

by Gordon

NOTES AND EVENTS



HOT SPOT.—This new heat-treatment plant at the Darley Dale works of Firth-Derihon Stampings, Ltd., has been installed to deal with the whole range of the highest-quality alloy and carbon steels and nickel-based and titanium alloys.

INSTRUMENT DIVISION. — Racal Engineering, Ltd., of Bracknell, Berks, has formed a separate division to deal with all matters relating to its range of instruments. The new division has its own development laboratories under the chief engineer, Mr. N. Elson, and also includes a special products section; its sales manager is Mr. I. H. M. Campbell.

CRANFIELD EXHIBITION.—More than 2,000 people attended a recent four-day exhibition at the College of Aeronautics, Cranfield, devoted to the latest developments and uses of nickel. The exhibition was organized by the Mond Nickel Co., Ltd., in co-operation with the College, and included a number of working demonstrations of the wide application of these materials in all branches of industry. One feature of the exhibition was a lecture symposium which covered the application of nickel alloys in aircraft engineering.

MOULDING POWDERS.—BX Plastics, Ltd., of Chingford, London, E.4, has produced a booklet entitled "Injection Moulding Materials," describing the general characteristics, types available, and uses in industry of a number of its materials.

MAGNESIUM DATA. — The Magnesium Industry Council has published a booklet illustrating the uses and properties of magnesium sand castings, gravity-die castings, pressure-die castings, sheet, extrusions and forgings.

MISSILE COMPONENTS. — Unitor plugs and sockets produced by Belling and Lee, Ltd., are used on the Seaslug, Bloodhound, Thunderbird and Firestreak missiles. New products of the company which may find missile application are the Domino range of miniature Unitor plugs and sockets and a miniature co-axial Unitor.

Company Notices

NEW COMPANY

Agricultural Aircraft Developments, Ltd. (614,640) —Private co. Reg. Nov. 11. Cap. £100 in 1s. shs. Objects: To act as designers, manufacturers of and dealers in all types of equipment and apparatus for disseminating fertilizers, chemicals and other substances in connection with the growing and control of all forms of crop, cereals, root crops, fruit and vegetables, and for the control of insects, viruses, blight, fungi, weeds and other growth; designers, manufacturers of and dealers in aircraft for use with or without such apparatus, etc. Permanent directors: Arthur O. Taylor, 35 Meadowhill Road, Redditch, director of A. Taylor and Son (Redditch), Ltd., etc.; Danny F. Speck, 61 Robbery Bottom Lane, Old Welwyn, Herts, director of Agricultural Aviation Co., Ltd.; Cecil H. Latimer-Needham, High Oaks, Deer Park, Wonersh, nr. Guildford, Surrey, director of Aeronautical Research and Design, Ltd., etc. Reg. off.: Panshanger Aerodrome, Hertford.

New Patents

APPLICATIONS ACCEPTED

807,233.—Link Aviation, Inc.—"Method and means for producing visual display in grounded aircraft trainers." — Sept. 21, 1955 (Sept. 21, 1954).

807,313.—Kelvin and Hughes, Ltd. — "Servo systems."—Jan. 25, 1957 (Feb. 13, 1956).

807,423.—Fairey Aviation Co., Ltd.—"Helicopters." —Feb. 7, 1957 (Feb. 8, 1956).

807,512.—Sperry Rand Corporation. — "Aircraft navigation instruments."—July 15, 1955 (July 30, 1954).

807,554.—Dowty Equipment, Ltd.—"Aircraft brake mechanism."—Sept. 24, 1956 (Sept. 23, 1955).

Applications open to public inspection on Jan. 14, 1959; opposition period expires on April 14, 1959.

Birth Notices

Cottam.—On Nov. 19, at R.A.F. Hospital, Cosford, to Elizabeth (*née* Wheatley), wife of Dr. J. Cottam, R.A.F.—a son.

Fairhurst.—On Nov. 17, at R.A.F. Hospital, Wroughton to Wendy (*née* Green), wife of Wg. Cdr. E. A. Fairhurst—a son.

Garing.—On Nov. 19, at St. Andrew's Hospital, Melbourne, to Marjorie (*née* Smith), wife of Air Cdre. W. H. Garing, R.A.A.F.—a daughter.

Griffiths.—On Nov. 20, at Louise Margaret Hospital, Aldershot, to Jennifer (*née* Stafford), wife of Flt. Lt. Michael Griffiths—a daughter.

Read.—On Nov. 18, at R.A.F. Hospital, St. Athan, to Joan (*née* Rosser), wife of Flt. Lt. G. Read—a son.

Smith.—On Nov. 24, at R.A.F. Hospital, Nocton Hall, to Janet (*née* Duke), wife of Flt. Lt. Ronald Smith—a son.

Stokes.—On Nov. 19, at B.M.H. Imtarfa, Malta, to Mary (*née* Howarth), wife of Flt. Lt. P. Stokes —a son

Thorne.—On Nov. 22, at Tidworth Military Hospital, to Moira (*née* Sheehan), wife of Sqn. Ldr. Neil C. Thorne—a son.

Aviation Calendar

December 5.—Helic. Assn. of G. B., film show, in the R.Ae.S. Library, 4 Hamilton Place, **London,** W.1, at 18.00 hrs.

December 6. — British Interplanetary Society lecture, "Rocket Nozzles and Exhaust Jets," by E. T. B. Smith, B.Sc., in the Tudor Room, Caxton Hall, Caxton Street, **London,** S.W.1, at 18.00 hrs.

December 8. — Royal Society of Arts Cantor Lecture, "The Future of the Aeroplane," by Eric Mensforth, C.B.E., M.A., M.I.Mech.E., F.R.Ae.S., at John Adam Street, **London,** W.C.2, at 18.00 hrs.

December 9.—R.Ae.S. Lecture, "Application of a Constant Frequency AC Electrical System to Aircraft and Missiles," by S. S. Hall and A. Thomas, in the Theatre, Park Lane House, Park Lane, **London,** W.1, at 19.00 hrs.

December 9. — R.Ae.S. Graduates and Students Section lecture, "The Future of the British Aircraft Industry," by E. C. Bowyer (director, S.B.A.C.), in the Library, 4 Hamilton Place, **London,** W.1, at 19.30 hrs.

December 9.—R.Ae.S. Glasgow Branch Graduates and Students Section Lecture, "Training the Aeronautical Engineer," by A. W. Babister, in the engineering department, University of **Glasgow,** at 19.30 hrs.

December 9.—R.Ae.S. Boscombe Down Branch lecture, "Beating the Heat Barrier," by J. Taylor, in the lecture hall, A. and A.E.E. **Boscombe Down,** at 17.45 hrs.

December 9. — R.Ae.S. Bristol Branch Junior Committee lecture, "Nuclear Propulsion," by A. D. Baxter at Filton House, **Bristol,** at 18.00 hrs.

December 10. — Royal United Service Institution film and commentary, "With the Army and the R.A.F. in the Middle and Far East," by William Courtney, at the Institution, Whitehall, **London,** S.W.1, at 15.00 hrs.

December 10. — British Institution of Radio Engineers, North Eastern Section lecture, "High Resolution Airfield Control and Ground Surveillance Radar," by P. H. Walker, at Neville Hall, Westgate Road, **Newcastle upon Tyne,** at 18.00 hrs.

December 10.—Kronfeld Club, film and talk on the Cambridge University Gliding Club by K. King, at 74 Eccleston Square, **London,** S.W.1.

December 10. — R.Ae.S. Manchester Branch lecture, "Civil Aircraft Production," by P. Imlach, in the Reynolds Hall, College of Technology, **Manchester,** at 19.30 hrs.

December 10. — R.Ae.S. Weybridge Branch, "R. K. Pierson Memorial Lecture," by B. S. Shenstone, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

December 10. — R.Ae.S. Gloucester and Cheltenham Branch lecture, "The Development of High Performance Sailplanes," by D. H. G. Ince, at the Wheatstone Hall, Brunswick Road, **Gloucester,** at 19.30 hrs.

December 10.—R.Ae.S. Coventry Branch, junior lecturettes and films, in the Wine Lodge, The Burges, **Coventry,** at 19.30 hrs.

December 10. — R.Ae.S. Southampton Branch lecture, "Aircraft Accident Investigation," by G. W. Acock (M.T.C.A.), in the Institute of Education, University of **Southampton,** at 20.00 hrs.

December 10.—R.Ae.S. Chester Branch lecture, (joint meeting with Chester section of the Society of Instrument Technology), "Interplanetary Instrumentation," by B. P. Clear (Jodrell Bank), in the lecture theatre, Grosvenor Museum, **Chester,** at 19.30 hrs.

December 10.—R.Ae.S. Brough Branch lecture, "Procedure of Test Flying at Supersonic Speeds," by R. P. Beamont (English Electric Co., Ltd.), in the lecture hall, Electricity Offices, Ferensway, **Hull,** at 19.30 hrs.

December 10.—R.Ae.S. Preston Branch lecture, "Emergency Stopping of Aircraft which overrun Airfield Runways," by Dr. J. Tomlinson (R.A.E. Bedford), at the R.A.F.A. Hall, **Preston,** at 19.30 hrs.

December 10. — R.Ae.S. Christchurch Branch lecture, "Electronic Control of Machine Tools," by H. Ogden, at the King's Arms Hotel, **Christchurch,** at 19.30 hrs.

December 10.—R.Ae.S. Reading Branch lecture, "Servicing of Civil Aircraft," by J. Gregory, in the canteen, Western Manufacturing, Ltd., **Reading,** at 18.15 hrs.

December 10.—R.Ae.S. Swindon Branch, "Any Questions," at The College, Victoria Road, **Swindon,** at 19.00 hrs.

December 11.—R.Ae.S. Isle of Wight Branch, A.G.M. and film show, at the Saunders-Roe Sports and Social Club, Church Path, **East Cowes,** at 18.00 hrs.

December 15.—R.Ae.S. All-day Discussion on Hypersonic Flow, at the Institution of Mechanical Engineers, Birdcage Walk, **London,** S.W.1, at 18.00 hrs.